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PB-268 339

# Ft. Loudoun Reservoir: Loudoun, Knox and Blount Counties Watts Bar Reservoir: Rhea, Meigs, Roane, Monroe, Cumberland, and Loudoun Counties. Chickamauga Reservoir: Hamilton, Rhea, Meigs, McMinn Counties. Nickajack Reservoir: Marion and Hamilton Counties, Tennessee

National Eutrophication Survey, Las Vegas, Nev.

Prepared for

Environmental Monitoring and Support Lab., Las Vegas, Nev.

Jan 77

PB 268 339

# U.S. ENVIRONMENTAL PROTECTION AGENCY
# NATIONAL EUTROPHICATION SURVEY

## WORKING PAPER SERIES

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REPORT ON

FT. LOUDOUN RESERVOIR
LOUDOUN, KNOX, & BLOUNT COUNTIES
WATTS BAR RESERVOIR
RHEA, MEIGS, ROANE, MONROE,
CUMBERLAND, & LOUDOUN COUNTIES
CHICKAMAUGA RESERVOIR
HAMILTON, RHEA, MEIGS, MC MINN COUNTIES
NICKAJACK RESERVOIR
MARION & HAMILTON COUNTIES
TENNESSEE

EPA REGION IV

WORKING PAPER NO. 446

WITH THE COOPERATION OF THE

TENNESSEE DEPARTMENT OF PUBLIC HEALTH

AND THE

TENNESSEE NATIONAL GUARD

January 1977

# REPORT ON

# FT. LOUDOUN RESERVOIR: LOUDOUN, KNOX, & BLOUNT COUNTIES

# WATTS BAR RESERVOIR: RHEA, MEIGS, ROANE, MONROE, CUMBERLAND, & LOUDOUN COUNTIES

# CHICKAMAUGA RESERVOIR: HAMILTON, RHEA, MEIGS, MC MINN COUNTIES

# NICKAJACK RESERVOIR: MARION & HAMILTON COUNTIES

## EPA REGION IV

by

National Eutrophication Survey

Water and Land Quality Branch
Monitoring Applications Laboratory
Environmental Monitoring and Support Laboratory
Las Vegas, Nevada

and

Eutruphication Survey Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 446

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

January 1977

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# FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

## OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

## ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

## LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Tennessee Department of Public Health for professional involvement, to the Tennessee National Guard for conducting the tributary sampling phase of the Survey, and to those Tennessee wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Division of Water Quality Control, Tennessee Department of Public Health; the Division of Environmental Planning, Tennessee Valley Authority; and the Nashville District Corps of Engineers provided invaluable documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper series.

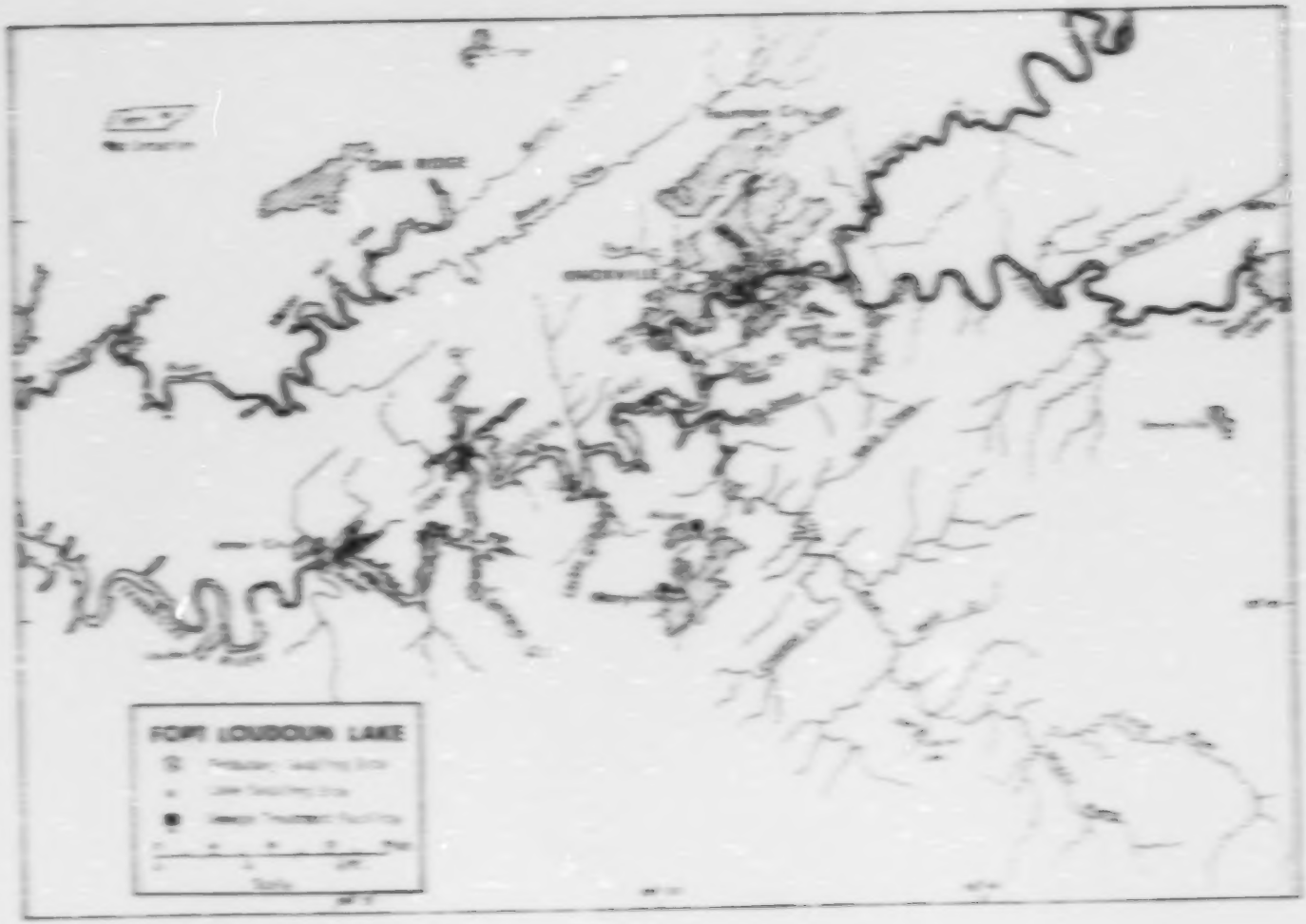
Major General William C. Smith, former Adjutant General of Tennessee, and Project Officer Colonel Wilburn C. Johnson, who directed the volunteer efforts of the Tennessee National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

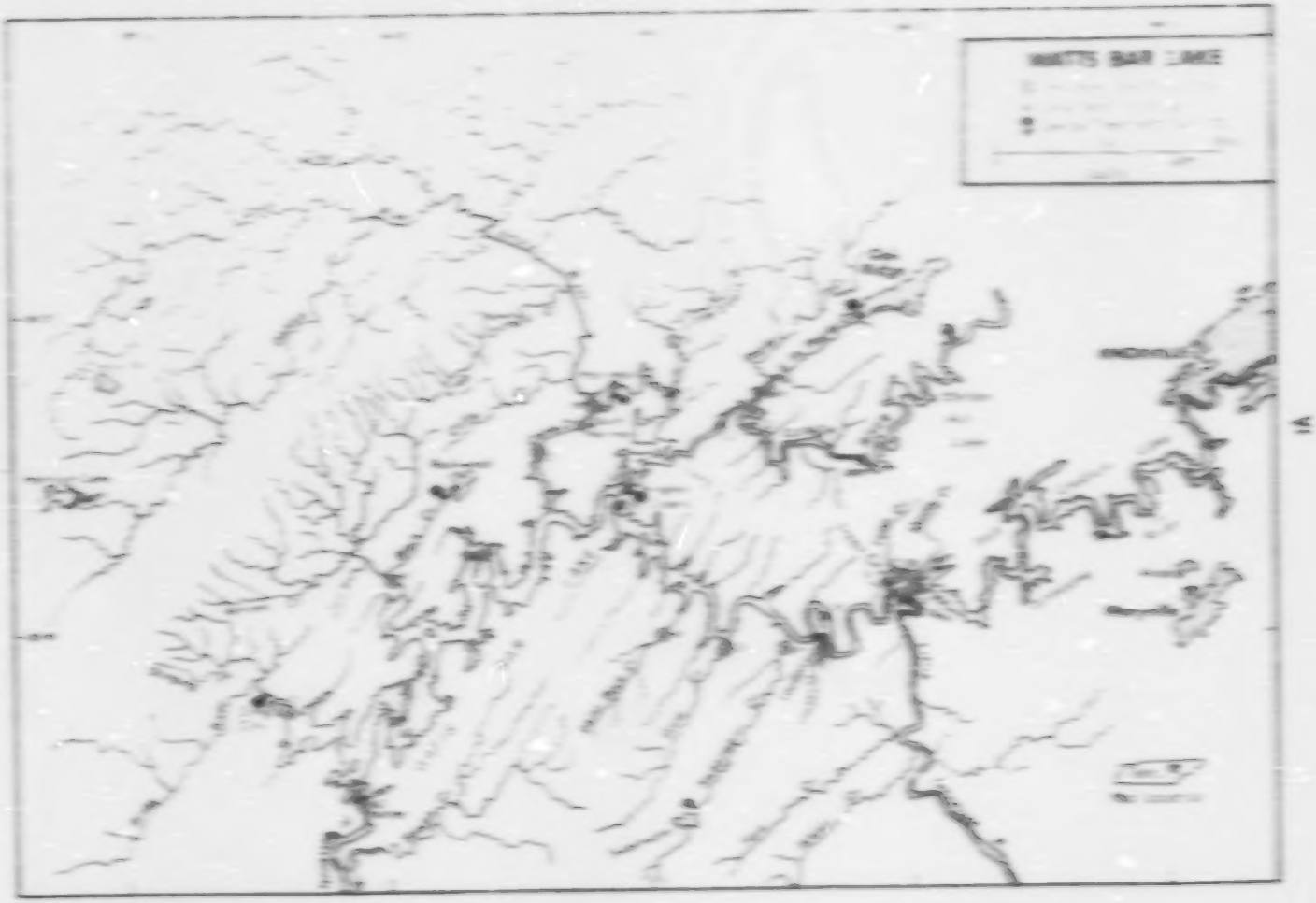
NATIONAL EUTROPHICATION SURVEY

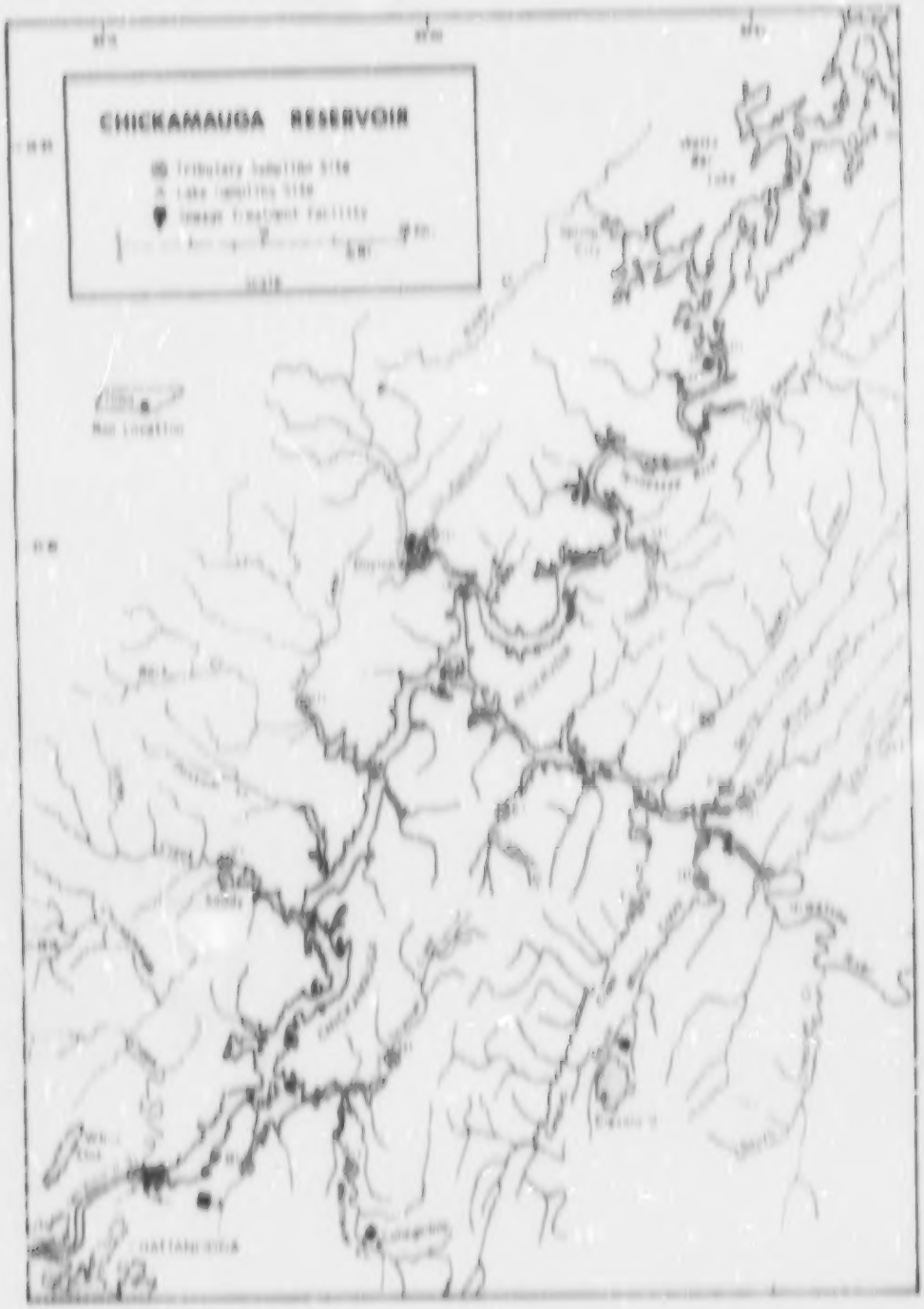
STUDY LAKES

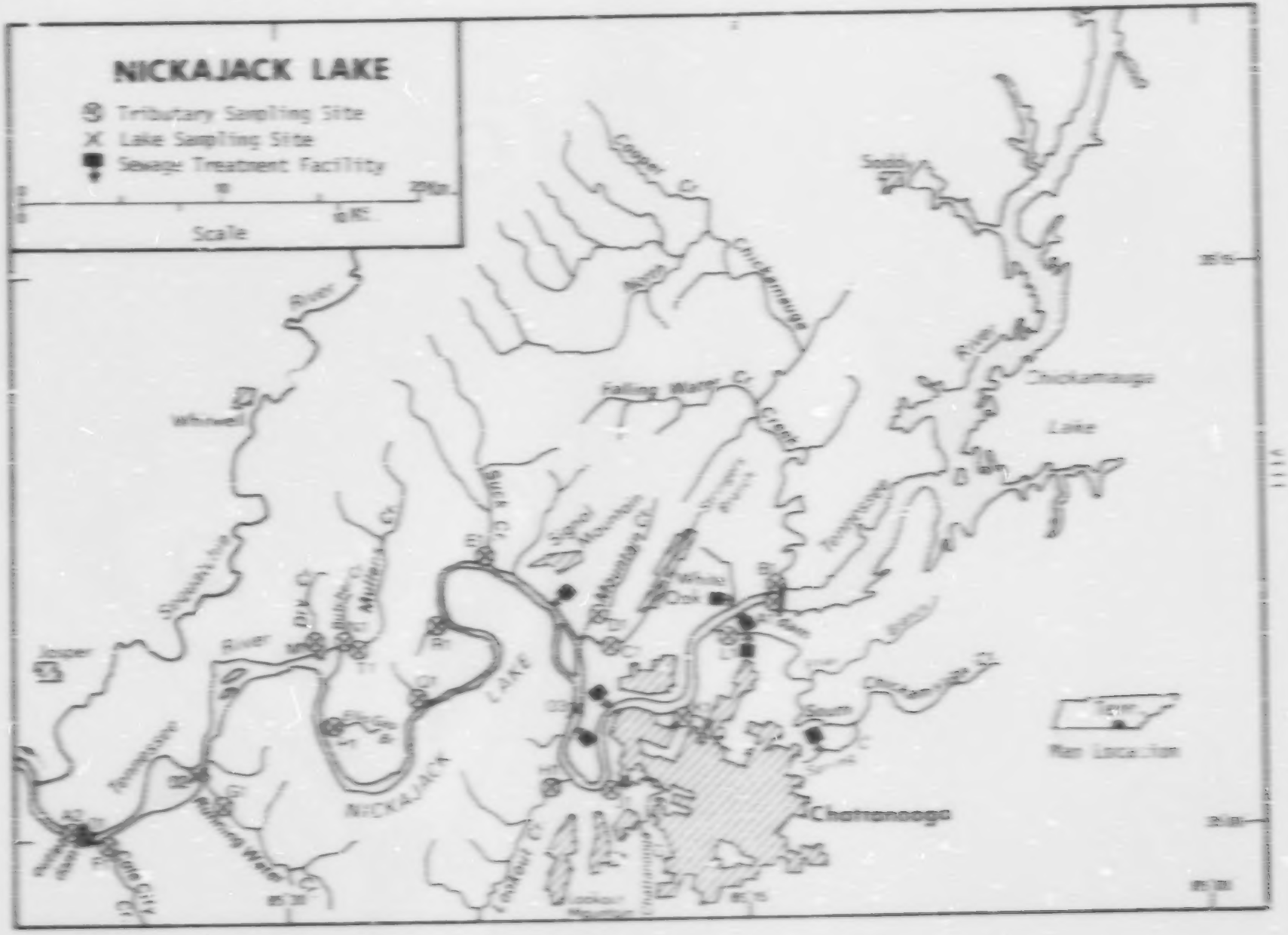
STATE OF TENNESSEE

| LAKE NAME | COUNTY |
|---|---|
| Barkley | Stewart, Montgomery (Trigg, Lyon in KY) |
| Boone | Washington, Sullivan, Carter |
| Cheatham | Cheatham, Davidson |
| Cherokee | Jefferson, Hamblen, Grainger, Hawkins |
| Chickamauga | Hamilton, Rhea, Meigs, McMinn |
| Douglas | Sevier, Jefferson, Cocke |
| Fort Loudon | Loudon, Knox, Blount |
| Great Falls | White, Van Buren |
| Nickajack | Marion, Hamilton |
| Old Hickory | Sumner, Davidson, Wilson, Smith, Trousdale |
| Percy Priest | Davidson, Rutherford |
| Reelfoot | Obion |
| South Holston | Sullivan (Washington in VA) |
| Tims Ford | Moore, Franklin |
| Watts Bar | Rhea, Meigs, Cumberland, Roane, Loudon |
| Woods (Elk River) | Franklin, Coffee |


FORT LOUDOUN LAKE




CHICKAMAUGA RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Map Location


NICKAJACK LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Scale
Cooper Cr
Chickamauga
Falling Water Cr
Creek
Whitwell
Suck Cr
Mullens Cr
Dry Cr
Jasper
Nickajack Cr
Running Water
Lake
Chickamauga
Lake
Nor Location
Chattanooga

REPORT ON FT. LOUDOUN, WATTS BAR, CHICKAMAUGA AND NICKAJACK RESERVOIRS.

STORET NOS. 4712, 4722, 4708, AND 4717

I. CONCLUSIONS

A. Trophic Condition:*

The Ft. Loudoun, Watts Bar, Chickamauga, and Nickajack impoundments are classified as eutrophic based upon Survey data. The reservoirs are characterized by moderately high nutrient levels, low Secchi disc visibility, and turbid, debris-filled water. Phytoplankton genera identified were generally pollution-tolerant forms. Algal blooms were noted by Survey limnologists for all of the reservoirs except Watts Bar, and heavy macrophyte growth was reported at Nickajack Reservoir.

Past studies [Tennessee Valley Authority (TVA), Stream Sanitation Staff, 1964; TVA, Water Quality Branch, 1967] indicate that watercraft with marine toilets are creating a special pollution problem in Tennessee lakes. This regular discharge of raw sewage directly into lakes presents a growing threat to recreational uses of each reservoir.

*See Appendix E.

B. Rate-Limiting Nutrient:

Algal assay results indicate that all four Tennessee River impoundments were limited by available phosphorus levels. Spikes with phosphorus, and with phosphorus and nitrogen simultaneously resulted in increases in assay yields. Spikes with nitrogen alone produced no positive growth response.

Ratios of available inorganic nitrogen to orthophosphorus in sampled waters substantiate phosphorus limitation.

C. Nutrient Controllability:

1. Point Sources -

The mean annual phosphorus load from point sources was estimated to be 40.3% of the total load reaching Ft. Loudoun Reservoir. The city of Knoxville contributed a total of 38.1% from three wastewater treatment plants. The remaining two known wastewater treatment plants contributed 2.1% of the total load.

Phosphorus loading from point sources was estimated to be 5.6% of the total reaching Watts Bar Reservoir. The city of Oak Ridge contributed a total of 2.6% from two plants, and the remaining eight known sewage treatment plants contributed 3.0% of the total phosphorus.

Point sources contributed an estimated 4.7% of the total phosphorus load reaching Chickamauga Reservoir. The city of Cleveland contributed 2.6% from one plant. The remaining five known plants contributed 2.1% of the total load.

Phosphorus loading from point sources was estimated to be 21.8% of the total reaching Nickajack Lake. The city of Chat'anooga contributed a total of 19.8% from two wastewater treatment plants. The remaining five known plants contributed 2.0% of the total load.

It should be noted that the percentages of the total phosphorus loads attributable to point sources for Watts Bar, Chickamauga, and Nickajack Reservoirs do not include a consideration of the quantity of phosphorus discharged to the next upstream reservoir from point sources. For example, it could be assumed that 40.1% of the total phosphorus discharged from the Ft. Loudoun Reservoir to Watts Bar Reservoir via the Tennessee River is attributable to point sources.

Present loading rates for the four Tennessee River impoundments were from three to eight times greater than those proposed by Vollenweider (1975) as "eutrophic" for lakes with such volume and retention times. Although Vollenweider's model may not apply to such highly turbid water bodies, or to those with short hydraulic retention times (18 days or less for all four reservoirs), these loadings are excessive and it is expected that reduction of nonpoint phosphorus loading as well as known point sources would be required to substantially improve river water quality.

The productivity of these reservoirs, as roughly estimated by the chlorophyll a levels developed, was considerably lower than would be expected based upon nutrient levels. The likely reason for this is the inability to develop phytoplankton levels to potential with such short retention times and light limitation caused by high suspended solids content.

F. Nonpoint Sources -

The mean annual phosphorus loads not attributable to point sources directly discharging to these lakes

1 of

**TECHNICAL REPORT DATA**

*(Please read Instructions on the reverse before completing)*

| 1. REPORT NO. | 2. | 3. RECIPIENT'S ACCESSION NO. |
|---|---|---|
| 4. TITLE AND SUBTITLE: Report on Ft Loudoun Reservoir, Loudoun, Knox, Blount Counties, Watts Bar Reservoir, Rhea, Meigs, Roane, Cumberland, Loudon Counties, Chickamauga Reservoir, Hamilton County, Nickajack Reservoir, Marion & Hamilton Counties, Tennessee. | | 5. REPORT DATE: Prepared January 1977<br>6. PERFORMING ORGANIZATION CODE |
| 7. AUTHOR(S): Anonymous (National Eutrophication Survey Staff) | | 8. PERFORMING ORGANIZATION REPORT NO: Working Paper No. 446 |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS: National Eutrophication Survey<br>U.S. Environmental Protection Agency<br>P.O. Box 15027<br>Las Vegas, NV 89114 | | 10. PROGRAM ELEMENT NO.<br>11. CONTRACT/GRANT NO. |
| 12. SPONSORING AGENCY NAME AND ADDRESS: Office of Research and Development<br>U.S. Environmental Protection Agency<br>401 M Street S. W.<br>Washington, DC 20460 | | 13. TYPE OF REPORT AND PERIOD COVERED: Final 1973<br>14. SPONSORING AGENCY CODE |

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| eutrophication<br>lakes<br>nutrients<br>phosphorus<br>nitrogen<br>loading | | 05B<br>05C |

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were about 59.6% of the total reaching Ft. Loudoun Reservoir, 94.4% of the total reaching Watts Bar Reservoir, 95.3% of the total reaching Chickamauga Reservoir, and 78.2% of the total impacting Nickajack Reservoir. Measured tributaries accounted for all but approximately 2.0% of these phosphorus loads.

There are a number of large industrial point sources impacting the four reservoirs (Tennessee Department of Public Health, 1974) which were not sampled by the National Eutrophication Survey in 1973, and so are not included in the lake nutrient budgets on pages 27-30. Included among these sources is C. F. Industries in Chattanooga which reportedly discharges 60,590 kg ammonia nitrogen and 30,660 kg nitrate nitrogen per year to Friar Branch of Nickajack Reservoir (L. Clark, pers. comm.). Additional study is needed to determine the impact of these sources on the calculated nutrient budgets of the four impoundments.

Many of the tributaries show a lower nitrogen to phosphorus (N/P) ratio than would be expected from natural runoff. Tributaries with inorganic nitrogen

to orthophosphorus ratios less than 15:1 are suspected of being impacted by a point source that was not accounted for in this Survey. The inorganic nitrogen to orthophosphorus ratios for Second Creek (5:1), Turkey Creek (5:1), Whites Creek (2:1), Candies Creek (10:1), and Citico Creek (7:1) fall into such a category.

## II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized on the the following page. Lake morphometry data and mean hydraulic retention times were provided by the Tennessee Valley Authority; tributary flow data were provided by the Tennessee District Office of the U.S. Geological Survey (USGS) (outlet drainage areas include the lake surface areas). Drainage area for First Creek, tributary C-1 (Ft. Loudoun Reservoir) was provided by the Tennessee Valley Authority. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

| | | Ft. Loudoun Reservoir | Watts Bar Reservoir | Chickamauga Reservoir | Nickajack Reservoir |
|---|---|---|---|---|---|
| 1. | Surface area ($km^2$): | 59.09 | 157.62 | 141.23 | 61.97 |
| 2. | Mean depth (meters): | 7.8 | 7.9 | 6.4 | 7.1 |
| 3. | Maximum depth (meters): | 26.2 | 37.0 | 28.0 | 29.6 |
| 4. | Volume (x $10^6$ $m^3$): | 464.755 | 1,449.362 | 911.556 | 511.334 |
| 5. | Mean hydraulic retention time (days): | 13 | 16 | 9 | 5 |

B. Tributary and Outlet (see Appendix B for flow data):

1. Tributaries -

| Ft. Loudon Reservoir | | | | Watts Bar Reservoir | | | |
|---|---|---|---|---|---|---|---|
| | Name | Drainage area ($km^2$) | Mean flow ($m^3/sec$) | | Name | Drainage area ($km^2$) | Mean flow ($m^3/sec$) |
| A(1) | French Broad River | 13,271.2 | 213.25 | A(1) | Tennessee River | 28,734.5 | 371.59 |
| B(1) | Holston River | 9,779.8 | 114.14 | B(1) | Muddy Creek | 26.5 | 0.53 |
| C(1) | First Creek | 57.2 | 0.72 | C(1) | Town Creek | 25.5 | 0.48 |
| D(1) | Second Creek | 18.4 | 0.31 | D(1) | Little Tennessee River | 6,803.9 | 166.90 |
| E(1) | Third Creek | 44.0 | 0.73 | E(1) | Steekee Creek | 18.6 | 0.36 |
| F(1) | Fourth Creek | 28.2 | 0.47 | F(1) | Sweetwater Creek | 168.2 | 3.15 |
| H(1) | Gallagher Creek | 59.6 | 1.26 | G(1) | Pond Creek | 96.6 | 1.86 |
| J(1) | Lackey Creek | 12.1 | 0.19 | H(1) | Paint Rock Creek | 81.1 | 1.55 |
| K(1) | Little River | 885.8 | 18.96 | J(1) | Piney River | 354.8 | 7.65 |
| L(1) | Stock Creek | 49.0 | 1.05 | K(1) | Whites Creek | 357.4 | 7.74 |
| M(1) | Turkey Creek | 64.2 | 1.20 | L(1) | Caney Creek | 70.4 | 1.47 |
| N(1) | Knob Creek | 16.5 | 0.35 | M(1) | Emory River | 2,240.3 | 45.02 |
| P(1) | Goose Creek | 9.4 | 0.16 | N(1) | Little Emory River | 108.9 | 2.23 |
| Q(1) | Baker Creek | 8.1 | 0.13 | P(1) | Poplar Creek | 352.2 | 7.77 |
| R(1) | Burnett Creek | 9.3 | 0.20 | Q(1) | Clinch River | 8,767.1 | 127.77 |
| | Minor tributaries and immediate drainage - | 354.1 | 9.19 | | Minor tributaries and immediate drainage - | 474.8 | 12.38 |
| | Total | 24,671.9 | 362.31 | | Total | 44,677.1 | 758.11 |
| 2. | Outlet - G(1) Tennessee River | 24,734.5 | 371.59 | | Outlet - A(2) Tennessee River | 44,832.9 | 761.35 |

C. Precipitation:

| | Ft. Loudon Reservoir | | Watts Bar Reservoir | |
|---|---|---|---|---|
| 1. | Year of sampling: | 178.1 centimeters | Year of sampling: | 168.4 centimeters |
| 2. | Mean annual: | 125.2 centimeters | Mean annual: | 136.7 centimeters |

B. Tributary and Outlet (see Appendix B for flow data) (continued):

1. Tributaries -

Chickamauga Reservoir

| Name | Drainage area ($km^2$) | Mean flow ($m^3/sec$) |
|---|---|---|
| B(I) Unnamed Creek | 3.2 | 0.08 |
| C(I) Wolftever Creek | 261.6 | 4.34 |
| D(I) Long Savannah Creek | 104.1 | 1.73 |
| E(I) Gunstocker Creek | 44.5 | 0.76 |
| F(I) Candies Creek | 290.1 | 4.95 |
| G(I) South Mouse Creek | 103.3 | 1.76 |
| H(I) Hiwassee River | 5,951.8 | 105.37 |
| J(I) North Mouse Creek | 242.7 | 4.28 |
| K(I) Spring Creek | 44.8 | 0.79 |
| L(I) Rogers Creek | 144.5 | 2.56 |
| M(I) Goodfield Creek | 64.5 | 1.14 |
| N(I) Sewee Creek | 318.6 | 5.65 |
| P(I) Tennessee River | 44,832.9 | 740.15 |
| R(I) Little Richland Creek | 47.7 | 1.11 |
| T(I) Richland Creek | 278.3 | 4.91 |
| U(I) Sale Creek | 390.4 | 7.02 |
| W(I) Soddy Creek | 178.2 | 3.57 |
| Minor tributaries and immediate drainage - | 569.6 | 13.33 |
| Total | 53,705.0 | 924.80 |
| 2. Outlet - A(I) Tennessee River | 53,346.1 | 927.75 |

Nickajack Reservoir

| Name | Drainage area ($km^2$) | Mean flow ($m^3/sec$) |
|---|---|---|
| A(I) Tennessee River | 53,846.1 | 927.75 |
| B(I) North Chickamauga Creek | 313.4 | 7.90 |
| C(I) Stringers Creek | 116.1 | 0.39 |
| D(I) Mountain Creek | 34.4 | 0.67 |
| E(I) Suck Creek | 518.6 | 1.53 |
| F(I) Cole City Creek | 75.1 | 1.36 |
| G(I) Running Water Creek | 54.6 | 1.37 |
| H(I) Lookout Creek | 488.3 | 8.77 |
| J(I) Chattanooga Creek | 198.5 | 3.53 |
| K(I) Citico Creek | 7.8 | 0.14 |
| L(I) South Chickamauga Creek | 1,207.8 | 21.22 |
| M(I) Dry Creek | 16.0 | 0.47 |
| N(I) Butcher Creek | 5.0 | 0.13 |
| P(I) Ellis Gap Branch | 3.7 | 0.09 |
| Q(I) Bill McNabb Gulf | 4.0 | 0.10 |
| R(I) Unnamed Creek | 2.3 | 0.06 |
| T(I) Mullens Creek | 45.0 | 1.35 |
| Minor tributaries and immediate drainage - | 240.9 | 5.26 |
| Total | 56,657.6 | 982.16 |
| Outlet - A(2) Tennessee River | 56,643.3 | 956.85 |

C. Precipitation:

| | | | |
|---|---|---|---|
| 1. Year of sampling: | 147.3 centimeters | Year of sampling: | 168.1 centimeters |
| 2. Mean annual: | 150.2 centimeters | Mean annual: | 132.1 centimeters |

## III. LAKE WATER QUALITY SUMMARY

Ft. Loudoun, Watts Bar, Chickamauga, and Nickajack Reservoirs were sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from each station on the lakes and from a number of depths at each station (see maps, pages v-viii). During each visit, a depth-integrated sample was collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first visit to each water body, an 18.9-liter depth-integrated sample was composited for algal assays. Maximum depths (expressed in meters) sampled were as follows:

| Ft. Loudoun | | Watts Bar | | Chickamauga | | Nickajack | |
|---|---|---|---|---|---|---|---|
| Station Number | Depth | Station Number | Depth | Station Number | Depth | Station Number | Depth |
| 1 | 24.1 | 1 | 23.8 | 1 | 16.5 | 1 | 15.8 |
| 2 | 10.4 | 2 | 17.7 | 2 | 19.8 | 2 | 21.3 |
| 3 | 14.6 | 3 | 16.5 | 3 | 14.0 | 3 | 11.3 |
| 4 | 13.7 | 4 | 13.1 | 4 | 10.4 | 4 | 11.9 |
| 5 | 9.1 | 5 | 23.2 | 5 | 7.6 | | |
| 6 | 9.1 | 6 | 8.8 | 6 | 12.2 | | |
| 7 | 9.7 | 7 | 11.0 | | | | |
| | | 8 | 10.1 | | | | |

For a more detailed explanation of NES methods, see NES Working Paper No. 175.

[illegible] LOCATION [illegible]
STUDY CODE [illegible]

## [illegible] AND CHEMICAL CHARACTERISTICS

| | | SURFACE | | | | BOTTOM | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | [illegible] = 7 | | | | [illegible] = 7 | | | | [illegible] = 7 | | | |
| [illegible] | NO. | RANGE | MEDIAN | MEAN OR RANGE | NO. | RANGE | MEDIAN | MEAN OR RANGE | NO. | RANGE | MEDIAN | MEAN OR RANGE | |
| TEMPERATURE (DEG CENT) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 17.8- 18.2 | 18.1 | 8.0- 8.3 | 14 | 23.7- 23.8 | 24.6 | 8.0- 14.5 | 12 | 21.3- 25.2 | 25.4 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 18.3- 18.9 | 18.5 | 7.9- 22.9 | 7 | 23.8- 24.2 | 23.9 | 4.0- 25.3 | 7 | 24.2- 25.- | 24.6 | 4.0- 13.7 | |
| [illegible] (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 0 | ********** | ***** | ********** | 7 | 4.1- 6.2 | 4.4 | 1.5- 14.5 | 0 | 6.2- 8.4 | 6.2 | 1.5- 14.5 | |
| MEAN DEPTH== | 7 | 7.2- 8.8 | 8.8 | 7.9- 22.9 | 7 | 4.1- 5.2 | 4.4 | 4.0- 25.3 | 7 | 6.2- 8.8 | 8.8 | 4.0- 13.7 | |
| CONDUCTANCE (UMHOS) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 185.- 268. | 208. | 8.0- 8.8 | 14 | 148.- 334. | 287. | 8.0- 14.5 | 12 | 192.- 234. | 212. | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 240.- 278. | 257. | 7.9- 22.9 | 7 | 25.- 278. | 211. | 4.0- 25.3 | 7 | 143.- 225. | 217. | 4.0- 13.7 | |
| PH (STANDARD UNITS) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 7.3- 7.1 | 7.5 | 8.0- 8.3 | 14 | 7.2- 6.9 | 7.3 | 8.0- 14.5 | 12 | 7.1- 8.4 | 7.8 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 7.6- 7.7 | 7.6 | 7.9- 22.9 | 7 | 7.1- 7.7 | 7.8 | 4.0- 25.3 | 7 | 7.1- 7.7 | 7.5 | 4.0- 13.7 | |
| TOTAL ALKALINITY (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 48.- 68. | 68. | 8.0- 8.8 | 14 | 54.- 85. | 65. | 8.0- 14.5 | 12 | 54.- 71. | 68. | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 53.- 68. | 66. | 7.9- 22.9 | 7 | 54.- 83. | 64. | 4.0- 25.3 | 7 | 58.- 78. | 68. | 4.0- 13.7 | |
| TOTAL P (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 0.[illegible]-0.043 | 0.042 | 8.0- 8.8 | 14 | 0.032-0.047 | 0.045 | 8.0- 14.5 | 12 | 0.04-0.052 | 0.078 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 0.04-0.113 | 0.054 | 7.9- 22.9 | 7 | 0.039-0.101 | 0.041 | 4.0- 25.3 | 7 | 0.04-0.07- | 0.078 | 4.0- 13.7 | |
| DISSOLVED ORTHO P (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 0.019-0.075 | 0.025 | 8.0- 8.8 | 14 | 0.008-0.027 | 0.019 | 8.0- 14.5 | 12 | 0.021-0.044 | 0.039 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 0.018-0.059 | 0.032 | 7.9- 22.9 | 7 | 0.01-0.071 | 0.019 | 4.0- 25.3 | 7 | 0.02-0.04- | 0.034 | 4.0- 13.7 | |
| NITRATE (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 0.34-0.48 | 0.44 | 8.0- 8.8 | 14 | 0.19-0.42 | 0.36 | 8.0- 14.5 | 12 | 0.35-0.43 | 0.38 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 0.41-0.61 | 0.77 | 7.9- 22.9 | 7 | 0.35-0.45 | 0.40 | 4.0- 25.3 | 7 | 0.38-0.45 | 0.38 | 4.0- 13.7 | |
| AMMONIA (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 0.04-0.14 | 0.05 | 8.0- 8.8 | 14 | 0.05-0.17 | 0.05 | 8.0- 14.5 | 12 | 0.03-0.10 | 0.07 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 0.0-0.14 | 0.10 | 7.9- 22.9 | 7 | 0.13-0.17 | 0.14 | 4.0- 25.3 | 7 | 0.07-0.22 | 0.10 | 4.0- 13.7 | |
| KJELDAHL N (MG/L) | | | | | | | | | | | | | |
| [illegible] = DEPTH | 7 | 0.49-1.07 | 0.69 | 8.0- 8.8 | 14 | 0.48-0.98 | 0.58 | 8.0- 14.5 | 12 | 0.27-1.05 | 0.59 | 8.0- 14.5 | |
| MEAN DEPTH== | 7 | 0.78-0.58 | 0.78 | 7.9- 22.9 | 7 | 0.48-0.78 | 0.59 | 4.0- 25.3 | 7 | 0.28-0.48 | 0.48 | 4.0- 13.7 | |
| ORGANIC HEAVY METALS | | | | | | | | | | | | | |
| | 0 | ********** | ***** | | 0 | ********** | ***** | | 0 | ********** | ***** | | |

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

[illegible]

| [illegible] | | [illegible] | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | [illegible] | | | | | [illegible] | | | | | | [illegible] | | | | |
| | | [illegible] | | | | | [illegible] | | | | | | [illegible] | | | | |
| [illegible] | N* | [illegible] | | | | N* | [illegible] | | | | N* | [illegible] | | | | | |
| TEMPERATURE (DEG CENT) | | | | | | | | | | | | | | | | | |
| [illegible] | 8 | 19.0- 40.3 | 31.5 | 1.0- 1.0 | 11 | 28.0- 38.0 | 34.0 | 0.0- 1.5 | 24 | 28.7- 34.0 | 33.- | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 15.7- 17.7 | 17.0 | 7.3- 22.0 | 0 | 34.0- 23.0 | 13.0 | 0.0- 23.0 | 0 | 20.0- 23.- | 17.- | 0.0- 12.0 | | | | | |
| DISSOLVED OXYGEN (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 8 | [illegible] | [illegible] | [illegible] | 0 | 3.0- 9.3 | 7.2 | 0.0- 1.5 | 0 | 9.0- 7.0 | 8.0 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 7.2- 10.0 | 7.6 | 7.3- 22.0 | 0 | 9.0- 7.0 | 3.7 | 0.0- 23.0 | 0 | 9.0- 7.0 | 8.0 | 0.0- 12.0 | | | | | |
| CONDUCTIVITY (UMHOS) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 78.- 168. | 156. | 0.0- 0.0 | 11 | 47.- 212. | 177. | 0.0- 1.5 | 24 | 144.- 233. | 178. | 0.0- 1.5 | | | | | |
| [illegible] | 5 | 45.- 225. | 154. | 7.3- 22.0 | 0 | 140.- 214. | 143. | 0.0- 23.0 | 0 | 137.- 184. | 155. | 0.0- 12.0 | | | | | |
| PH (STANDARD UNITS) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 6.0- 8.5 | 7.7 | 0.0- 0.0 | 11 | 7.0- 8.0 | 7.8 | 0.0- 1.5 | 24 | 7.3- 8.1 | 7.6 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 7.3- 8.1 | 7.6 | 7.3- 22.0 | 0 | 7.0- 7.8 | 7.7 | 0.0- 23.0 | 0 | 7.3- 7.7 | 7.3 | 0.0- 12.0 | | | | | |
| TOTAL ALKALINITY (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 26.- 85. | 47. | 0.0- 0.0 | 11 | 23.- 92.- | 68. | 0.0- 1.5 | 24 | 44.- 108. | 74. | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 24.- 105. | 84. | 7.3- 22.0 | 0 | 58.- 94. | 78. | 0.0- 23.0 | 0 | 38.- 69. | 55. | 0.0- 12.0 | | | | | |
| TOTAL P (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 0.017-0.048 | 0.029 | 0.0- 0.0 | 11 | 0.030-0.047 | 0.035 | 0.0- 1.5 | 24 | 0.020-0.032 | 0.024 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 0.022-0.045 | 0.032 | 7.3- 22.0 | 0 | 0.017-0.053 | 0.041 | 0.0- 23.0 | 0 | 0.027-0.037 | 0.030 | 0.0- 12.0 | | | | | |
| DISSOLVED ORTHO P (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 0.009-0.017 | 0.012 | 0.0- 0.0 | 11 | 0.009-0.017 | 0.011 | 0.0- 1.5 | 24 | 0.007-0.013 | 0.010 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 0.009-0.023 | 0.014 | 7.3- 22.0 | 0 | 0.007-0.021 | 0.013 | 0.0- 23.0 | 0 | 0.007-0.017 | 0.011 | 0.0- 12.0 | | | | | |
| NO2+NO3 (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 0.470-0.590 | 0.495 | 0.0- 0.0 | 11 | 0.330-0.536 | 0.466 | 0.0- 1.5 | 24 | 0.424-0.534 | 0.500 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 0.139-0.610 | 0.516 | 7.3- 22.0 | 0 | 0.348-0.520 | 0.440 | 0.0- 23.0 | 0 | 0.048-0.485 | 0.345 | 0.0- 12.0 | | | | | |
| AMMONIA (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 0.029-0.119 | 0.060 | 0.0- 0.0 | 11 | 0.030-0.128 | 0.078 | 0.0- 1.5 | 24 | 0.040-0.078 | 0.054 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 0.040-0.116 | 0.078 | 7.3- 22.0 | 0 | 0.050-0.188 | 0.095 | 0.0- 23.0 | 0 | 0.010-0.092 | 0.046 | 0.0- 12.0 | | | | | |
| KJELDAHL N (MG/L) | | | | | | | | | | | | | | | | | |
| [illegible] | 7 | 0.780-0.980 | 0.880 | 0.0- 0.0 | 11 | 0.720-0.940 | 0.788 | 0.0- 1.5 | 24 | 0.760-0.960 | 0.840 | 0.0- 1.5 | | | | | |
| [illegible] | 0 | 0.760-0.980 | 0.850 | 7.3- 22.0 | 0 | 0.780-0.980 | 0.907 | 0.0- 23.0 | 0 | 0.780-0.880 | 0.820 | 0.0- 12.0 | | | | | |
| SECCHI DISC (METERS) | | | | | | | | | | | | | | | | | |
| | 0 | [illegible] | [illegible] | | 0 | [illegible] | [illegible] | | 0 | [illegible] | [illegible] | | | | | | |

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** N = NO. OF SITES SAMPLED ON THIS DATE

[illegible]

PHYSICAL AND CHEMICAL CHARACTERISTICS

| CHARACTER | N | SURFACE: VALUE | SURFACE: MEDIAN | SURFACE: MAX DEPTH RANGE (METERS) | N | MIDDEPTH: RANGE | MIDDEPTH: MEDIAN | MIDDEPTH: MAX DEPTH RANGE (METERS) | N | BOTTOM: RANGE | BOTTOM: MEDIAN | BOTTOM: MAX DEPTH RANGE (METERS) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE (DEG. CENT) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 23.0- 30.0 | 24.0 | 0.0- 0.0 | 12 | 22.0- 42.0 | 24.1 | 0.0- 1.5 | 12 | 17.0- 24.0 | 20.0 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 19.0- 24.0 | 19.9 | 0.0- 24.0 | 0 | 11.0- 25.0 | 15.7 | 0.0- 13.7 | 0 | 17.0- 25.0 | 17.0 | 0.0- 13.7 |
| DISSOLVED OXYGEN (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | | | | 5 | 5.0- 9.0 | 7.0 | 1.5- 3.5 | 3 | 5.0- 7.0 | 7.0 | 1.5- 3.5 |
| MAX DEPTHS | 0 | 5.0- 8.0 | 7.5 | 0.0- 24.0 | 0 | 3.0- 8.0 | 5.7 | 0.0- 13.7 | 0 | 5.0- 7.0 | 8.0 | 0.0- 13.7 |
| CONDUCTIVITY (UMHOS) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 148.- 168. | 158. | 0.0- 0.0 | 12 | 118.- 178. | 175. | 0.0- 1.5 | 12 | 95.- 172. | 160. | 0.0- 1.5 |
| MAX DEPTHS | 0 | 138.- 165. | 151. | 0.0- 24.0 | 0 | 111.- 178. | 166. | 0.0- 13.7 | 0 | 95.- 171. | 162. | 0.0- 13.7 |
| PH (STANDARD UNITS) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 7.3- 7.6 | 7.4 | 0.0- 0.0 | 12 | 7.1- 7.6 | 7.5 | 0.0- 1.5 | 12 | 7.2- 7.6 | 7.5 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 7.3- 7.5 | 7.3 | 0.0- 24.0 | 0 | 7.0- 7.5 | 7.4 | 0.0- 13.7 | 0 | 7.2- 7.6 | 7.5 | 0.0- 13.7 |
| TOTAL ALKALINITY (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 43.- 71. | 53. | 0.0- 0.0 | 12 | 39.- 88. | 66. | 0.0- 1.5 | 12 | 33.- 67. | 59. | 0.0- 1.5 |
| MAX DEPTHS | 0 | 44.- 71. | 52. | 0.0- 24.0 | 0 | 29.- 88. | 65. | 0.0- 13.7 | 0 | 33.- 67. | 59. | 0.0- 13.7 |
| TOTAL P (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 0.029-0.043 | 0.031 | 0.0- 0.0 | 12 | 0.021-0.076 | 0.025 | 0.0- 1.5 | 12 | 0.030-0.044 | 0.032 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 0.030-0.039 | 0.032 | 0.0- 24.0 | 0 | 0.022-0.047 | 0.027 | 0.0- 13.7 | 0 | 0.030-0.047 | 0.034 | 0.0- 13.7 |
| DISSOLVED ORTHO P (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 0.005-0.015 | 0.011 | 0.0- 0.0 | 12 | 0.004-0.014 | 0.010 | 0.0- 1.5 | 12 | 0.004-0.014 | 0.013 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 0.006-0.015 | 0.012 | 0.0- 24.0 | 0 | 0.004-0.014 | 0.009 | 0.0- 13.7 | 0 | 0.007-0.014 | 0.014 | 0.0- 13.7 |
| NO2+NO3 (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 0.219-0.440 | 0.395 | 0.0- 0.0 | 12 | 0.143-0.438 | 0.365 | 0.0- 1.5 | 12 | 0.220-0.358 | 0.335 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 0.140-0.438 | 0.395 | 0.0- 24.0 | 0 | 0.140-0.347 | 0.348 | 0.0- 13.7 | 0 | 0.219-0.348 | 0.335 | 0.0- 13.7 |
| AMMONIA (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 0.010-0.108 | 0.075 | 0.0- 0.0 | 12 | 0.010-0.188 | 0.075 | 0.0- 1.5 | 12 | 0.050-0.097 | 0.064 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 0.010-0.124 | 0.078 | 0.0- 24.0 | 0 | 0.010-0.181 | 0.045 | 0.0- 13.7 | 0 | 0.050-0.094 | 0.066 | 0.0- 13.7 |
| ORGANIC N (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 0 | 0.401-0.788 | 0.568 | 0.0- 0.0 | 12 | 0.353-0.688 | 0.388 | 0.0- 1.5 | 12 | 0.288-0.488 | 0.356 | 0.0- 1.5 |
| MAX DEPTHS | 0 | 0.348-0.685 | 0.388 | 0.0- 24.0 | 0 | 0.288-0.388 | 0.388 | 0.0- 13.7 | 0 | 0.288-0.388 | 0.388 | 0.0- 13.7 |
| SECCHI DISC METERS | 0 | | | | 0 | | | | 0 | | | |

# N = NO. OF SAMPLES
## MAXIMUM DEPTH SAMPLED AT EACH SITE
### N = NO. OF SITES SAMPLED ON THIS DATE

PHYSICAL AND CHEMICAL CHARACTERISTICS

| PARAMETER | NO. | SURFACE: RANGE | SURFACE: MEDIAN | SURFACE: MEAN DEPTH RANGE (METERS) | NO. | BOTTOM: RANGE | BOTTOM: MEDIAN | BOTTOM: MEAN DEPTH RANGE (METERS) | NO. | COMPOSITE: RANGE | COMPOSITE: MEDIAN | COMPOSITE: MEAN DEPTH RANGE (METERS) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TEMPERATURE (DEG. CENT.) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 14.0- 15.0 | 14.5 | 0.0- 0.0 | 7 | 25.2- 45.0 | 34.8 | 0.0- 1.5 | 7 | 14.0- 44.2 | 34.0 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 14.2- 15.0 | 14.3 | 4.7- 27.4 | 4 | 28.0- 31.7 | 28.8 | 5.4- 14.3 | 4 | 14.0- 45.7 | 18.9 | 0.0- 14.6 |
| DISSOLVED OXYGEN (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 2 | ---------- | ----- | ---------- | 4 | 5.2- 6.3 | 5.5 | 0.0- 1.5 | 4 | 6.0- 7.3 | 6.7 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 7.0- 7.0 | 7.5 | 0.2- 28.2 | 4 | 5.0- 5.4 | 5.4 | 5.4- 14.3 | 4 | 6.0- 7.2 | 6.9 | 0.0- 14.6 |
| CONDUCTIVITY (UMHOS) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 210.- 335. | 285. | 0.0- 0.0 | 7 | 150.- 173. | 162. | 0.0- 1.5 | 7 | 161.- 172. | 166. | 0.0- 1.5 |
| MEAN DEPTH | 4 | 210.- 248. | 248. | 4.2- 28.1 | 4 | 144.- 164. | 157. | 5.4- 14.2 | 4 | 146.- 188. | 166. | 0.0- 14.6 |
| PH (UNITS) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 7.2- 7.4 | 7.2 | 0.0- 0.0 | 7 | 6.4- 7.2 | 6.8 | 0.0- 1.5 | 7 | 7.4- 7.5 | 7.4 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 7.2- 7.4 | 7.2 | 0.2- 28.2 | 4 | 6.2- 6.6 | 6.5 | 5.4- 14.3 | 4 | 7.2- 7.4 | 7.4 | 0.0- 14.6 |
| TOTAL ALKALINITY (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 55.- 77. | 57. | 0.0- 0.0 | 7 | 50.- 60. | 55. | 0.0- 1.5 | 7 | 58.- 62. | 59. | 0.0- 1.5 |
| MEAN DEPTH | 4 | 54.- 64. | 58. | 0.2- 28.2 | 4 | 51.- 58. | 52. | 5.4- 14.3 | 4 | 57.- 59. | 58. | 0.2- 14.6 |
| TOTAL P (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 0.034-0.579 | 0.054 | 0.0- 0.0 | 7 | 0.025-0.442 | 0.037 | 0.0- 1.5 | 7 | 0.047-0.054 | 0.052 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 0.034-0.059 | 0.051 | 0.2- 28.2 | 4 | 0.029-0.073 | 0.039 | 5.4- 14.3 | 4 | 0.050-0.062 | 0.055 | 0.0- 14.6 |
| DISSOLVED ORTHO P (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 0.019-0.365 | 0.034 | 0.0- 0.0 | 7 | 0.023-0.259 | 0.025 | 0.0- 1.5 | 7 | 0.025-0.035 | 0.029 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 0.017-0.031 | 0.021 | 0.2- 28.2 | 4 | 0.017-0.043 | 0.026 | 5.4- 14.3 | 4 | 0.023-0.031 | 0.029 | 0.0- 14.6 |
| NO2+NO3 (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 1.420-2.470 | 2.440 | 0.0- 0.0 | 7 | 2.340-2.470 | 2.402 | 0.0- 1.5 | 7 | 0.350-0.397 | 0.370 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 2.420-2.440 | 2.435 | 0.2- 28.2 | 4 | 0.340-0.446 | 0.405 | 5.4- 14.3 | 4 | 0.350-0.390 | 0.370 | 0.0- 14.6 |
| AMMONIA (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 0.048-0.299 | 0.105 | 0.0- 0.0 | 7 | 0.060-0.123 | 0.095 | 0.0- 1.5 | 7 | 0.070-0.120 | 0.090 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 0.060-0.125 | 0.105 | 0.2- 28.2 | 4 | 0.070-0.127 | 0.098 | 5.4- 14.3 | 4 | 0.070-0.100 | 0.090 | 0.0- 14.6 |
| KJELDAHL N (MG/L) | | | | | | | | | | | | |
| 0.0-1.5 M DEPTH | 4 | 0.310-2.480 | 0.480 | 0.0- 0.0 | 7 | 0.300-0.600 | 0.450 | 0.0- 1.5 | 7 | 0.280-0.480 | 0.350 | 0.0- 1.5 |
| MEAN DEPTH | 4 | 0.370-0.480 | 0.480 | 0.2- 28.2 | 4 | 0.310-0.480 | 0.380 | 5.4- 14.3 | 4 | 0.290-0.330 | 0.300 | 0.0- 14.6 |
| SECCHI DISC (METERS) | 3 | ---------- | ----- | | 0 | ---------- | ----- | | 0 | ---------- | ----- | |

* 1 = TOTAL OF SAMPLES
** MEDIAN DEPTH SAMPLED AT EACH SITE
*** 1 = TOTAL OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

| Sampling Date | Dominant Genera | Algal Units per ml |
|---|---|---|
| **St. Loudoun Reservoir** | | |
| 05/24/73 | 1. Melosira | 2,746 |
| | 2. Centric Diatom | 1,227 |
| | 3. Flagellates | 1,070 |
| | 4. Pennate Diatom | 301 |
| | 5. Dactylococcopsis | 89 |
| | Other genera | 248 |
| | Total | 5,617 |
| 06/24/73 | 1. Asterionella | 1,356 |
| | 2. Synedra | 1,069 |
| | 3. Flagellates | 443 |
| | 4. Melosira | 234 |
| | 5. Cyclotella | 130 |
| | Other genera | 416 |
| | Total | 3,648 |
| 10/27/73 | 1. Flagellates | 1,755 |
| | 2. Melosira | 428 |
| | 3. Trachelomonas | 274 |
| | 4. Dactylococcopsis | 117 |
| | 5. Cyclotella | 57 |
| | Other genera | 327 |
| | Total | 2,938 |
| **Watts Bar Reservoir** | | |
| 05/25/73 | 1. Melosira | 3,315 |
| | 2. Flagellates | 1,138 |
| | 3. Stephanodiscus | 201 |
| | 4. Synedra | 100 |
| | 5. Asterionella | 67 |
| | Other genera | 277 |
| | Total | 5,098 |
| 08/24/73 | 1. Flagellates | 2,107 |
| | 2. Asterionella | 987 |
| | 3. Melosira | 702 |
| | 4. Synedra | 241 |
| | 5. Cyclotella | 176 |
| | Other genera | 484 |
| | Total | 4,697 |
| 10/24/73 | 1. Flagellates | 919 |
| | 2. Melosira | 427 |
| | 3. Scenedesmus | 130 |
| | 4. Stephanodiscus | 98 |
| | 5. Centric Diatom | 66 |
| | Other genera | 260 |
| | Total | 1,900 |

9. Biological Characteristics (continued):

1. Phytoplankton -

| Chickamauga Reservoir | | | | Nickajack Reservoir | | | |
|---|---|---|---|---|---|---|---|
| Sampling Date | Dominant Genera | | Algal Units per ml | Sampling Date | Dominant Genera | | Algal Units per ml |
| 05/23/73 | 1. | Flagellates | 438 | 05/23/73 | 1. | Melosira | 967 |
| | 2. | Melosira | 385 | | 2. | Flagellates | 606 |
| | 3. | Rhoicosigm | 204 | | 3. | Cyclotella | 119 |
| | 4. | Cyclotella | 172 | | 4. | Dactylococcopsis | 87 |
| | 5. | Dactylococcopsis | 71 | | 5. | Cocconeidiscus | 43 |
| | | Other genera | 215 | | | Other genera | 151 |
| | | Total | 1,345 | | | Total | 1,873 |
| 06/22/73 | 1. | Flagellates | 247 | 08/18/73 | 1. | Flagellates | 1,303 |
| | 2. | Nephrocytis | 207 | | 2. | Melosira | 318 |
| | 3. | Synedra | 121 | | 3. | Cyclotella | 143 |
| | 4. | Melosira | 107 | | 4. | Fragillaria | 143 |
| | 5. | Mitzschia | 94 | | 5. | Cryptomonas | 95 |
| | | Other genera | 305 | | | Other genera | 319 |
| | | Total | 1,073 | | | Total | 2,321 |
| 10/26/73 | 1. | Flagellates | 974 | 10/30/73 | 1. | Flagellates | 409 |
| | 2. | Melosira | 220 | | 2. | Pennate Diatom | 85 |
| | 3. | Synedra | 79 | | 3. | Oscillatoria | 28 |
| | 4. | Scenedesmus | 47 | | 4. | Centric Diatom | 28 |
| | 5. | Navicula | 32 | | 5. | Navicula | 14 |
| | | Other genera | 46 | | | Other genera | --- |
| | | Total | 1,398 | | | Total | 564 |

2. Chlorophyll a -

Ft. Loudoun Reservoir

| Sampling Date | Station Number | Chlorophyll a (ug/l) |
|---|---|---|
| 05/24/73 | 1 | 10.4 |
| | 2 | 13.0 |
| | 3 | 7.3 |
| | 4 | 3.8 |
| | 5 | 5.7 |
| | 6 | 3.0 |
| | 7 | 1.5 |
| 08/24/73 | 1 | 11.2 |
| | 2 | 6.4 |
| | 3 | 3.4 |
| | 4 | 1.9 |
| | 5 | 1.9 |
| | 6 | 2.3 |
| | 7 | 2.4 |
| 10/27/73 | 1 | 13.3 |
| | 2 | 3.4 |
| | 3 | 5.4 |
| | 4 | 2.5 |
| | 5 | 1.6 |
| | 6 | 1.1 |
| | 7 | 0.8 |

Watts Bar Reservoir

| Sampling Date | Station Number | Chlorophyll a (ug/l) |
|---|---|---|
| 05/25/73 | 1 | 4.4 |
| | 2 | 8.8 |
| | 3 | 10.5 |
| | 4 | 4.6 |
| | 5 | 6.3 |
| | 6 | 2.7 |
| | 7 | 3.7 |
| | 8 | 3.2 |
| 08/24/73 | 1 | 27.4 |
| | 2 | 13.0 |
| | 3 | 6.0 |
| | 4 | 5.5 |
| | 5 | 7.0 |
| | 6 | 4.0 |
| | 7 | 2.4 |
| | 8 | 4.2 |
| 10/24/73 | 1 | 4.2 |
| | 2 | 3.0 |
| | 3 | 7.5 |
| | 4 | 4.6 |
| | 5 | 2.5 |
| | 6 | 1.1 |
| | 7 | 4.7 |
| | 8 | 1.7 |

2. Chlorophyll a (corrected) -

Chickamauga Reservoir

| Sampling Date | Station Number | Chlorophyll a (ug/l) |
|---|---|---|
| 05/23/73 | 1 | 3.8 |
| | 2 | 5.8 |
| | 3 | 5.8 |
| | 4 | 2.2 |
| | 5 | 3.9 |
| | 6 | 1.6 |
| 08/22/73 | 1 | 3.7 |
| | 2 | 4.1 |
| | 3 | 3.8 |
| | 4 | 3.2 |
| | 5 | 4.3 |
| | 6 | 3.6 |
| 10/29/73 | 1 | 2.3 |
| | 2 | 2.3 |
| | 3 | 1.6 |
| | 4 | 2.1 |
| | 5 | 2.3 |
| | 6 | 1.2 |

Nickajack Reservoir

| Sampling Date | Station Number | Chlorophyll a (ug/l) |
|---|---|---|
| 05/23/73 | 1 | 3.2 |
| | 2 | 3.4 |
| | 3 | 2.4 |
| | 4 | 2.4 |
| 08/18/73 | 1 | 5.6 |
| | 2 | 5.3 |
| | 3 | 3.8 |
| | 4 | 4.1 |
| 10/30/73 | 1 | 1.8 |
| | 2 | 1.3 |
| | 3 | 1.1 |
| | 4 | 1.3 |

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

| Spike(mg/l) | Ft. Loudoun Reservoir | | | Watts Bar Reservoir | | |
|---|---|---|---|---|---|---|
| | Ortho P Conc.(mg/l) | Inorganic N Conc.(mg/l) | Maximum Yield (mg/l-dry wt.) | Ortho P Conc.(mg/l) | Inorganic N Conc.(mg/l) | Maximum Yield (mg/l-dry wt.) |
| | Stations 1 & 2 | | | Stations 1, 2, & 3 | | |
| Control | 0.016 | 0.756 | 2.5 | 0.012 | 0.554 | 0.2 |
| 0.05 P | 0.066 | 0.756 | 17.9 | 0.062 | 0.554 | 10.7 |
| 0.05 P + 1.0 N | 0.066 | 1.756 | 19.5 | 0.062 | 1.554 | 15.5 |
| 1.00 N | 0.016 | 1.756 | 2.8 | 0.012 | 1.554 | 0.1 |
| | Stations 3, 4, & 5 | | | Stations 7 & 8 | | |
| Control | 0.020 | 0.776 | 4.0 | 0.008 | 0.334 | 0.1 |
| 0.05 P | 0.070 | 0.776 | 28.3 | 0.058 | 0.334 | 5.6 |
| 0.05 P + 1.0 N | 0.070 | 1.776 | 26.3 | 0.058 | 1.334 | 15.2 |
| 1.00 N | 0.020 | 1.776 | 5.9 | 0.008 | 1.334 | 0.1 |
| | Stations 6 & 7 | | | | | |
| Control | 0.020 | 0.668 | 5.0 | | | |
| 0.05 P | 0.070 | 0.668 | 12.9 | | | |
| 0.05 P + 1.0 N | 0.070 | 1.668 | 21.0 | | | |
| 1.00 N | 0.020 | 1.668 | 5.1 | | | |

C. Limiting Nutrient Study (continued):

1. Autoclaved, filtered, and nutrient spiked -

| Spikes(1) | Chickamauga Reservoir: Ortho P Conc.(mg/l) | Chickamauga Reservoir: Inorganic N Conc.(mg/l) | Chickamauga Reservoir: Maximum Yield (mg/l-dry wt.) | Nickajack Reservoir: Ortho P Conc.(mg/l) | Nickajack Reservoir: Inorganic N Conc.(mg/l) | Nickajack Reservoir: Maximum Yield (mg/l-dry wt.) |
|---|---|---|---|---|---|---|
| | Stations 1, 2, & 3 | | | Stations 1, 2, 3, & 4 | | |
| Control | 0.012 | 0.426 | 0.3 | 0.020 | 0.514 | 5.1 |
| 0.05 P | 0.062 | 0.426 | 10.9 | 0.070 | 0.514 | 9.2 |
| 0.05 P + 1.0 N | 0.062 | 1.426 | 22.7 | 0.070 | 1.514 | 16.9 |
| 1.00 N | 0.012 | 1.426 | 0.2 | 0.020 | 1.514 | 5.3 |
| | Stations 4, 5, & 6 | | | | | |
| Control | 0.012 | 0.378 | 0.6 | | | |
| 0.05 P | 0.062 | 0.378 | 10.5 | | | |
| 0.05 P + 1.0 N | 0.062 | 1.378 | 20.5 | | | |
| 1.00 N | 0.012 | 1.378 | 0.4 | | | |

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity was moderately high in the Ft. Loudoun and Nickajack Reservoirs at the time of sampling, probably due to the respective proximity of these reservoirs to the cities of Knoxville and Chattanooga. The potential for primary production was moderately low in the Watts Bar and Chickamauga impoundments. In all four impoundments, the increase in yield with the addition of phosphorus, and the lack of response when only nitrogen was added, indicate phosphorus limitation. Maximum growth potential was achieved with the simultaneous addition of both phosphorus and nitrogen.

The ratios of inorganic nitrogen to orthophosphorus in lake data were 25:1 or greater on all three sampling occasions on Watts Bar Reservoir and 27:1 or greater on Chickamauga Reservoir. A minimum N:P ratio of 14:1 is considered necessary for phosphorus limitation to occur.

Mean N:P ratios for Ft. Loudoun Reservoir were 29:1 and 28:1 for the first two sampling occasions, but a ratio of 13:1 was observed in the October sample, suggesting near nitrogen limitation at that time.

Ratios for Nickajack Reservoir were 14:1 and 13:1 during May and August sampling, suggesting colimitation or near nitrogen limitation, but 17:1 in the October sample, indicating phosphorus limitation at that time.

## IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Tennnssee National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the maps (pages v-viii), except for the high runoff months of February and March when two samples were collected. Sampling was begun in April 1973 and was completed in March 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Tennessee District Office of the USGS for the tributary sites nearest each lake.

In this report, nutrient loads for sampled tributaries except South Mouse Creek, 0-1 and Richland Creek, T-1 (Chickamauga Reservoir) were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $kg/km^2/yr$ for Pond Creek, Lackey Creek, Stock Creek, and Knob Creek at Stations G(1), J(1), L(1), and N(1), respectively (Ft. Loudoun and Watts Bar); Long Savannah

Creek, Gunstocker Creek, Candies Creek, Rogers Creek, Sewee Creek, and Soddy Creek at Stations D(1), E(1), F(1), L(1), N(1), and V(1), respectively (Chickamauga); Suck Creek and Mullens Creek at Stations E(1) and T(1), respectively (Nickajack); and multiplying the means by the appropriate drainage areas in $km^2$. The annual nutrient loadings of South Mouse Creek, G(1), and Richland Creek, T(1), were calculated in the same manner as a "ZZ" for Chickamauga Reservoir.

The operators of the Knoxville (three plants), Alcoa, Maryville, Lenoir City, Loudoun, Harriman, Sweetwater, Dayton, Chattanooga (Brainerd, Moccasin Bend), and East Ridge wastewater treatment plants provided monthly effluent samples and corresponding flow data. Nutrient loads for the Kingston (two plants), Rockwood, Spring City, Cleveland, Red Bank/White Oak, Signal Mountain, U.S. Military Reservation #1, Oak Ridge (West), Collegedale, and Athens #1 wastewater treatment plants were estimated at 1.134 kg P and 3.401 kg N/capita/year

A. Waste Sources:

1. Known municipal -

| Name | Population Served | Treatment | Mean Flow ($m^3/d \times 10^3$) | Receiving Water |
|---|---|---|---|---|
| Ft. Loudoun Reservoir: | | | | |
| Lovers Creek (Knoxville) | 8,400 | 1. | 8.753 | Holston River |
| Alcoa | 12,000 | 1. | 5.906 | Pistol Creek/Little River |
| Maryville | 11,000 | 1. | 5.473 | Pistol Creek/Little River |
| Third Creek (Knoxville)* | 96,000 | 2. | 140.050 | Tennessee River |
| Fourth Creek (Knoxville) | 32,000 | 2. | 29.083 | Tennessee River |
| Watts Bar Reservoir: | | | | |
| Lenoir City** | 4,500 | 1. | 2.196 | Tennessee River |
| Loudon | 3,860 | 1. | 1.371 | Tennessee River |
| Harriman** | 7,000 | 1. | 10.936 | Emory River |
| Sweetwater** | 3,500 | 1. | 4.164 | Sweetwater Creek |
| Kingston #1 | 5,000 | 4. | 1.892† | Clinch River |
| Kingston #2 | 1,640 | 4. | 0.621† | Clinch River |
| Rockwood** | 4,000 | 1. | 1.517† | Black Creek |
| Spring City | 1,800 | 2. | 0.681† | Piney River |
| West Oak Ridge†† | 18,000 | 3. | 6.813† | East Fork Poplar Creek |
| East Oak Ridge†† | 12,000 | 2. | 4.542† | Melton Hill Lake/Clinch River |

2. Known industrial -

Ft. Loudoun and Watts Bar Reservoirs - see footnotes * and ** ;

Key: 1. Trickling filter
2. Activated sludge
3. Primary clarification
4. Stabilization pond

*Approximately 25% of total waste contributed by industry, i.e., meat processing, paper mills, and plastics. (Information provided by plant operator.)

**More than 25% of total waste load contributed by industry, i.e.: Lenoir City, Sweetwater - respectively, 35% and 42% meat packing and textile dye waste; Harriman - 30% paper and hosiery mills; Rockwood - 75% textile dye waste.

†Estimated at 0.3785 $m^3$/capita/day.

††U.S. Environmental Protection Agency, 1971.

A. Waste Sources (continued):

1. Known municipal -

| Name | Population Served | Treatment | Mean Flow ($m^3/d \times 10^3$) | Receiving Water |
|---|---|---|---|---|
| Chickamauga Reservoir: | | | | |
| Cleveland | 30,000 | 1. | 11.355* | South Mouse Creek |
| Dayton | 4,261 | 2. | 0.614 | Hitchland Creek |
| U.S. Military Reservation #1 | 700 | 3. | 0.265* | Unnamed Creek/Waconda Bay |
| Watts Bar Steam Plant | 40 | ** | 0.018* | Tennessee River |
| Collegedale | 3,021 | 2. | 1.147* | Wolftever Creek |
| Athens #1 | 17,000 | 6. | 6.670* | Chestanaula Creek |
| Nickajack Reservoir: | | | | |
| Moccasin Bend (Chattanooga)† | 85,000 | 6. | 102.898 | Tennessee River |
| Red Bank/White Oak†† | 10,000 | 3. | 3.785* | Tennessee River |
| Signal Mountain | 2,000 | 2. | 0.757* | Tennessee River |
| Brainerd (Chattanooga) | 35,063 | 5. | 16.107 | S. Chickamauga Creek |
| East Ridge | 22,500 | 3. | 8.752 | Spring Creek/W. Chickamauga Creek/S. Chickamauga Creek |
| Chattanooga Vocational and Technical School | 400 | 4. | 0.151* | Tennessee River |
| Lupton City§ | 1,500 | 3. | 0.568* | Tennessee River |

2. Known industrial -

| Name | Product | Treatment | Mean Flow ($m^3/d \times 10^3$) | Receiving Water |
|---|---|---|---|---|
| Chickamauga Reservoir: | | | | |
| U.S. Military Reservation #2 | Watertype TNT | 6. | Unknown | Unnamed Creek/Waconda Bay |

Nickajack Reservoir - see footnotes † and § ;

Key: 1. Unknown
2. Activated sludge
3. Trickling filter
4. Primary clarification
5. Extended Aeration
6. Tertiary

*Estimated at 0.3785 $m^3$/capita/day.

**Septic tank with effluent going through two fly ash ponds.

†Approximately 60% of total waste load to plant is chemical industrial contribution, i.e., tannery, metal plating, bleaching.

††U.S. Environmental Protection Agency, 1971.

§Lupton City also handles industrial waste from a yarn mill.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

| Source | Ft. Loudoun Reservoir kg P/yr | % of total | Source | Watts Bar Reservoir kg P/yr | % of total |
|---|---|---|---|---|---|
| a. Tributaries (nonpoint load) - | | | a. Tributaries (nonpoint load) - | | |
| A(1) French Broad River | 347,380 | 34.7 | A(1) Tennessee River | 700,985 | 50.5 |
| B(1) Holston River | 159,445 | 15.9 | B(1) Muddy Creek | 490 | <0.1 |
| C(1) First Creek | 2,645 | 0.3 | C(1) Town Creek | 575 | <0.1 |
| D(1) Second Creek | 4,105 | 0.4 | D(1) Little Tennessee River | 139,700 | 10.1 |
| E(1) Third Creek | 2,555 | 0.3 | E(1) Citico Creek | 500 | <0.1 |
| F(1) Fourth Creek | 1,405 | 0.1 | F(1) Sweetwater Creek | 12,165 | 0.9 |
| H(1) Gallagher Creek | 1,500 | 0.2 | G(1) Pond Creek | 3,915 | 0.3 |
| J(1) Lackey Creek | 180 | <0.1 | H(1) Point Rock Creek | 1,375 | 0.1 |
| K(1) Little River | 59,090 | 5.9 | J(1) Piney River | 2,805 | 0.2 |
| L(1) Stock Creek | 1,845 | 0.2 | K(1) Whites Creek | 73,115 | 5.0 |
| M(1) Turkey Creek | 9,195 | 0.9 | L(1) Caney Creek | 1,915 | 0.2 |
| N(1) Knob Creek | 565 | <0.1 | M(1) Emory River | 66,185 | 3.5 |
| P(1) Goose Creek | 820 | <0.1 | N(1) Little Emory River | 1,680 | 0.1 |
| Q(1) Baker Creek | 215 | <0.1 | P(1) Poplar Creek | 17,785 | 1.4 |
| R(1) Burnett Creek | 210 | <0.1 | Q(1) Clinch River | 143,005 | 10.9 |
| b. Minor tributaries and immediate drainage (nonpoint load) - | 10,775 | 1.1 | b. Minor tributaries and immediate drainage (nonpoint load) - | 14,220 | 1.1 |
| c. Known municipal STP's - | | | c. Known municipal STP's - | | |
| Loves Creek (Knoxville) | 17,755 | 1.8 | Lenoir City | 5,660 | 0.5 |
| Alcoa | 10,835 | 1.1 | Loudon | 4,460 | 0.3 |
| Maryville | 10,150 | 1.0 | Harriman | 11,845 | 0.9 |
| Third Creek (Knoxville) | 312,340 | 31.7 | Sweetwater | 2,930 | 0.2 |
| Fourth Creek (Knoxville) | 61,090 | 6.1 | Kingston #1 | 5,670 | 0.4 |
| | | | Kingston #2 | 1,060 | 0.1 |
| | | | Rockwood | 5,445 | 0.4 |
| | | | Spring City | 2,040 | 0.2 |
| | | | West Oak Ridge | 20,415 | 1.5 |
| | | | East Oak Ridge | 13,610 | 1.0 |
| d. Septic tanks[a] - | 170 | <0.1 | d. Septic tanks[a] - | 75 | <0.1 |
| e. Known industrial - | | | e. Known industrial - | | |
| f. Direct precipitation[b] - | 1,035 | 0.1 | f. Direct precipitation[b] - | 2,760 | 0.2 |
| Totals | 1,001,625 | 100.0 | Totals | 1,370,230 | 100.0 |
| 2. Output - Q(1) Tennessee River | 748,460 | | Output - A(2) Tennessee River | 1,016,950 | |
| 3. Net annual P accumulation - | 253,175 | | Net annual P accumulation - | 291,280 | |

[a]Estimate for Ft. Loudoun Reservoir based on 501 lakeside residences and 2 camps.
Estimate Watts Bar Reservoir based on 230 lakeside residences and 0 camps.

[b]Estimated (see NES Working Paper No. 175).

(See p.25, footnotes * and **.)

B. Annual Total Phosphorus Loading - Average Year (continued):

1. Inputs -

| Chickamauga Reservoir | | | | Nickajack Reservoir | | | |
|---|---|---|---|---|---|---|---|
| | Source | kg P/yr | % of total | | Source | kg P/yr | % of total |
| a. | Tributaries (nonpoint load) - | | | a. | Tributaries (nonpoint load) - | | |
| | B(1) Unnamed Creek | 219 | <0.1 | | A(1) Tennessee River | 1,161,548 | 66.9 |
| | C(1) Wolftever Creek | 12,145 | 0.9 | | B(1) North Chickamauga Creek | 5,465 | 0.3 |
| | D(1) Long Savannah Creek | 1,217 | 0.1 | | C(1) Citrincers Creek | 1,380 | 0.1 |
| | E(1) Gunstocker Creek | 900 | 0.1 | | D(1) Mountain Creek | 815 | 0. |
| | F(1) Candies Creek | 11,455 | 0.9 | | E(1) Duck Creek | 395 | <0.1 |
| | G*1) South Mouse Creek | 2,065 | 0.2 | | F(1) Cole City Creek | 1,385 | 0.1 |
| | H(1) Hiawassee River | 131,880 | 10.1 | | G(1) Running Water Creek | 1,065 | 0.1 |
| | J*1) North Mouse Creek | 8,815 | 0.6 | | H(1) Lookout Creek | 18,765 | 1.1 |
| | K( ) Spring Creek | 1,025 | 0.1 | | J(1) Chattanooga Creek | 34,575 | 2.0 |
| | L(1) Rogers Creek | 2,510 | 0.2 | | K(1) Citico Creek | 2,215 | 0.1 |
| | M(1) Goodfield Creek | 1,135 | 0.1 | | L(1) South Chickamauga Creek | 127,315 | 7.3 |
| | N(1) Sewee Creek | 6,880 | 0.5 | | M(1) Dry Creek | 95 | <0.1 |
| | P(1) Tennessee River | 1,044,160 | 79.8 | | N(1) Butcher Creek | 85 | <0.1 |
| | R(1) Little Richland Creek | 1,055 | 0.1 | | P(1) Ellis Gap Creek | 15 | <0.1 |
| | T(1) Richland Creek | 4,205 | 0.3 | | Q(1) Dill McNabb Gulf | 80 | <0.1 |
| | U(1) Sale Creek | 3,170 | 0.2 | | R(1) Unnamed Creek | 10 | <0.1 |
| | V(1) Soddy Creek | 930 | 0.1 | | T(1) Mullens Creek | 210 | <0.1 |
| b. | Minor tributaries and immediate drainage (nonpoint load) - | 11,397 | 0.9 | b. | Minor tributaries and immediate drainage (nonpoint load) - | 1,445 | 0.1 |
| c. | Known municipal STP's - | | | c. | Known municipal STP's - | | |
| | Cleveland | 35,020 | 2.6 | | Moccasin Bend (Chattanooga) | 297,070 | 17.2 |
| | Dayton | 4,840 | 0.4 | | Red Bank/White Oak | 7,935 | 0.5 |
| | U.S. Military Reservation #1 | 795 | 0.1 | | Signal Mountain | 2,205 | 0.1 |
| | Watts Bar Steam Plant* | 55 | <0.1 | | Brainerd (Chattanooga) | 44,875 | 2.6 |
| | Collegedale | 3,435 | 0.3 | | East Ridge | 23,370 | 1.3 |
| | Athens | 17,010 | 1.3 | | Chattanooga Vocational and Technical School | 455 | <0.1 |
| | | | | | Lupton City | 1,700 | 0.1 |
| d. | Septic tanks** - | 65 | <0.1 | d. | Septic tanks** - | 60 | <0.1 |
| e. | Known industrial - | | | e. | Known industrial - | | |
| | U.S. Military Reservation #2 | 0 | 0.0 | | | | |
| f. | Direct precipitation†† - | 2,505 | 0.2 | f. | Direct precipitation†† - | 735 | <0.1 |
| | Totals | 1,306,155 | 100.0 | | Totals | 1,736,765 | 100.0 |
| 2. | Output - (1) Tennessee River | 1,101,375 | | | Output - A(2) Tennessee River | 1,554,480 | |
| 3. | Net annual P accumulation - | 204,980 | | | Net annual P accumulation - | 181,125 | |

*Estimate for Watts Bar Steam Plant based on 19 employees at Watts Bar Hydro Plant.

**Estimate for Chickamauga Reservoir based on 135 lakeside residences and 5 camps.
Estimate for Nickajack Reservoir based on 219 lakeside residences.

†See p. 26, footnotes † and 5 .

††Estimated (see NES Working Paper No. 175.

1. Annual Total Nitrogen Loading - Average Year:

   1. Inputs -

| Source | kg N/yr | % of total |
|---|---|---|
| **Ft. Loudoun Reservoir** | | |
| a. Tributaries (nonpoint load) - | | |
| A(1) French Broad River | 7,884,984 | 60.7 |
| B(1) Holston River | 4,307,315 | 33.8 |
| C(1) First Creek | 34,360 | 0.3 |
| D(1) Second Creek | 23,610 | 0.2 |
| E(1) Third Creek | 58,315 | 0.4 |
| F(1) Fourth Creek | 28,705 | 0.2 |
| H(1) Gallagher Creek | 53,980 | 0.4 |
| J(1) Lackey Creek | 6,590 | 0.1 |
| K(1) Little River | 912,670 | 6.5 |
| L(1) Stock Creek | 20,590 | 0.2 |
| M(1) Turkey Creek | 71,560 | 0.5 |
| N(1) Knob Creek | 8,425 | 0.1 |
| P(1) Goose Creek | 7,610 | 0.1 |
| Q(1) Baker Creek | 7,910 | 0.1 |
| R(1) Burnett Creek | 4,376 | <0.1 |
| b. Minor tributaries and immediate drainage (nonpoint load) - | 219,410 | 1.6 |
| c. Known municipal STP's - | | |
| Loves Creek (Knoxville) | 32,390 | 0.2 |
| Alcoa | 21,500 | 0.1 |
| Maryville | 23,135 | 0.2 |
| Third Creek (Knoxville) | 814,136 | 5.8 |
| Fourth Creek (Knoxville) | 136,340 | 1.0 |
| d. Septic tanks[a] - | 6 136 | <0.1 |
| e. Known industrial[**] - | | |
| f. Direct precipitation[†] - | 61,795 | 0.5 |
| Totals | 13,950,380 | 100.0 |
| 2. Output - U(1) Tennessee River | 17,124,690 | |
| 3. Net annual N export[††] - | 3,166,310 | |

| Source | kg N/yr | % of total |
|---|---|---|
| **Watts Bar Reservoir** | | |
| a. Tributaries (nonpoint load) - | | |
| A(1) Tennessee River | 12,622,100 | 58.9 |
| B(1) Muddy Creek | 18,065 | 0.1 |
| C(1) Town Creek | 18,130 | 0.1 |
| D(1) Little Tennessee River | 3,413,850 | 15.9 |
| E(1) Citico Creek | 8,865 | <0.1 |
| F(1) Sweetwater Creek | 142,800 | 0.7 |
| G(1) Pond Creek | 62,275 | 0.3 |
| H(1) Paint Rock Creek | 45,745 | 0.2 |
| J(1) Piney River | 77,175 | 0.4 |
| K(1) Whites Creek | 290,990 | 1.3 |
| L(1) Caney Creek | 41,005 | 0.2 |
| M(1) Emory River | 754,645 | 3.5 |
| N(1) Little Emory River | 30,830 | 0.1 |
| P(1) Poplar Creek | 251,010 | 1.2 |
| Q(1) Clinch River | 2,963,065 | 13.8 |
| b. Minor tributaries and immediate drainage (nonpoint load) - | 289,615 | 1.3 |
| c. Known municipal STP's - | | |
| Lenoir City | 13,560 | 0.1 |
| Loudon | 7,300 | <0.1 |
| Harriman | 79,200 | 0.4 |
| Sweetwater | 8,640 | <0.1 |
| Kingston #1 | 17,005 | 0.1 |
| Kingston #2 | 5,930 | <0.1 |
| Rockwood | 16,375 | 0.1 |
| Spring City | 6,120 | <0.1 |
| West Oak Ridge | 61,220 | 0.3 |
| East Oak Ridge | 40,810 | 0.2 |
| d. Septic tanks[a] - | 3,970 | <0.1 |
| e. Known industrial[**] - | | |
| f. Direct precipitation[†] - | 170,300 | 0.8 |
| Totals | 21,443,650 | 100.0 |
| Output - A(2) Tennessee River | 20,612,910 | |
| Net annual N accumulation - | 830,745 | |

[a]Estimate for Ft. Loudoun based on 681 lakeside residences and 2 camps.
Estimate for Watts Bar based on 283 lakeside residences and 6 camps.

[**]See p. 25, footnotes * and **.

[†]Estimated (see NES Working Paper No. 175).

[††]Calculated export probably due to unknown sources and/or sampling error.

C. Annual Total Nitrogen Loading - Average Year (continued):

1. Inputs -

| Source | Chickamauga Reservoir kg N/yr | % of total | Nickajack Reservoir kg N/yr | % of total |
|---|---|---|---|---|
| a. Tributaries (nonpoint load) - | | | | |
| A(1) Tennessee River | | | 20,237,670 | 85.8 |
| B(1) Unnamed Creek | 33,010 | 0.1 | | |
| C(1) Whiteoak Creek | 132,065 | 0.3 | | |
| D(1) Long Savannah Creek | 61,875 | 0.1 | | |
| E(1) Gunstocker Creek | 17,210 | <0.1 | | |
| F(1) Candies Creek | 137,365 | 0.3 | | |
| G(1) South Mouse Creek | 41,115 | 0.1 | | |
| H(1) Hiwassee River | 2,602,040 | 5.2 | | |
| I(1) North Mouse Creek | 167,625 | 0.4 | | |
| J(1) Spring Creek | 10,320 | <0.1 | | |
| K(1) Rogers Creek | 53,040 | 0.1 | | |
| L(1) Goodfield Creek | 28,135 | 0.1 | | |
| M(1) Sewee Creek | 150,090 | 0.3 | | |
| N(1) Tennessee River | 41,729,506 | 90.0 | | |
| O(1) Little Richland Creek | 37,135 | 0.1 | | |
| P(1) Richland Creek | 83,700 | 0.2 | | |
| Q(1) Hale Creek | 190,005 | 0.4 | | |
| V(1) Soddy Creek | 46,065 | 0.1 | | |
| W(1) Chattanooga Creek | | | 1,120,100 | 4.8 |
| X(1) Citico Creek | | | 13,060 | 0.1 |
| Y(1) South Chickamauga Creek | | | 1,120,100 | 4.8 |
| Z(1) Dry Creek | | | 14,506 | 0.1 |
| A(2) Butcher Creek | | | 1,635 | <0.1 |
| B(2) Ellis Gap Creek | | | 1,455 | <0.1 |
| C(2) Bill McNabb Gulf | | | 1,335 | <0.1 |
| D(2) Unnamed Creek | | | 750 | <0.1 |
| E(2) Mullens Creek | | | 23,495 | 0.1 |
| b. Minor tributaries and immediate drainage (nonpoint load) - | 226,780 | 0.5 | 110,330 | 0.5 |
| c. Known municipal STP's - | | | | |
| Cleveland | 192,030 | 0.2 | | |
| Dayton | 10,365 | <0.1 | | |
| U.S. Military Reservation #1 | 9,380 | <0.1 | | |
| Watts Bar Steam Plant | 105 | <0.1 | | |
| Collegedale | 10,310 | <0.1 | | |
| Athens | 51,015 | 0.1 | | |
| Ringgold | | | 892,045 | 3.8 |
| Red Bank/White Oak | | | 23,810 | 0.1 |
| Signal Mountain | | | 6,000 | <0.1 |
| Brainerd (Chattanooga) | | | 95,605 | 0.4 |
| East Ridge | | | 51,090 | 0.2 |
| Chattanooga Vocational and Technical School | | | 1,380 | <0.1 |
| Lupton City | | | 5,100 | <0.1 |
| d. Septic tanks* - | 1,700 | <0.1 | 2,335 | <0.1 |
| e. Known industrial - | | | | |
| U.S. Military Reservation #2 | 0 | 0.0 | | |
| f. Direct precipitation† - | 194,855 | 0.3 | 45,310 | 0.2 |
| Totals | 46,352,370 | 100.0 | 23,577,660 | 100.0 |
| 2. Output - A(1) Tennessee River | 28,652,900 | | Output - A(2) Tennessee River | 23,668,705 |
| 3. Net annual N accumulation - | 17,699,350 | | Net annual N export†† - | 91,045 |

*Estimate for Chickamauga based on 130 lakeside residences and 5 camps.
Estimate for Nickajack based on 210 lakeside residences.

**See p. 20, Footnotes † and ‡.

†Estimated (see MES Working Paper No. 175).

††Calculated export probably due to unknown point sources and/or sampling error.

B. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Ft. Loudoun and Watts Bar Reservoirs

| Tributary | kg P/km²/yr | kg N/km²/yr |
|---|---|---|
| French Broad River | 26 | 534 |
| Holston River | 16 | 440 |
| First Creek | 46 | 600 |
| Second Creek | 227* | 1,278 |
| Third Creek | 58 | 1,325 |
| Fourth Creek | 50 | 1,021 |
| Gallagher Creek | 26 | 906 |
| Lackey Creek | 12 | 710 |
| Little River | 63 | 1,030 |
| Stock Creek | 33 | 575 |
| Turkey Creek | 149* | 1,115 |
| Knob Creek | 34 | 511 |
| Goose Creek | 45 | 831 |
| Baker Creek | 26 | 976 |
| Burnett Creek | 23 | 470 |
| Tennessee River | 31 | 510 |
| Muddy Creek | 17 | 634 |
| Tewk Creek | 22 | 476 |
| Little Tennessee River | 20 | 502 |
| Steekee Creek | 27 | 477 |
| Sweetwater Creek | 74 | 870 |
| Pond Creek | 40 | 645 |
| Paint Rock Creek | 17 | 564 |
| Piney River | 8 | 217 |
| Whites Creek | 220* | 781 |
| Caney Creek | 27 | 582 |
| Emory River | 21 | 337 |
| Little Emory River | 15 | 285 |
| Poplar Creek | 50 | 713 |
| Clinch River | 16 | 338 |

Chickamauga and Nickajack Reservoirs

| Tributary | kg P/km²/yr | kg N/km²/yr |
|---|---|---|
| Unnamed Creek | 67 | 16,561* |
| Wolftever Creek | 46 | 516 |
| Long Savannah Creek | 16 | 498 |
| Gunstocker Creek | 20 | 367 |
| Candies Creek | 39 | 473 |
| South Mouse Creek | 20 | 398 |
| Hiwassee River | 22 | 464 |
| North Mouse Creek | 28 | 691 |
| Spring Creek | 23 | 409 |
| Rogers Creek | 17 | 367 |
| Goodfield Creek | 18 | 438 |
| Sewee Creek | 22 | 377 |
| Little Richland Creek | 22 | 779 |
| Richland Creek | 20 | 398 |
| Sale Creek | 10 | 632 |
| Soddy Creek | 5 | 269 |
| North Chickamauga Creek | 17 | 637 |
| Stringers Creek | 86 | 1,226 |
| Mountain Creek | 24 | 644 |
| Suck Creek | 7 | 369 |
| Cole City Creek | 18 | 435 |
| Running Water Creek | 19 | 409 |
| Lookout Creek | 39 | 672 |
| Chattanooga Creek | 178* | 1,592 |
| Citico Creek | 254* | 1,739 |
| South Chickamauga Creek | 105 | 932 |
| Dry Creek | 6 | 906 |
| Butcher Creek | 5 | 327 |
| Ellis Gap Branch | 4 | 393 |
| Bill McNabb Gulf | 5 | 334 |
| Unnamed Creek | 4 | 326 |
| Mullens Creek | 5 | 546 |

*Background levels for these tributaries probably inflated by unknown point sources upstream.

E. Yearly Loadings:

In the following table, the existing phosphorus annual loadings are compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading should be considered one between "eutrophic" and "oligotrophic".

Note that Vollenweider's model may not be applicable to water bodies with very short retention times or in which light penetration is severely restricted from high concentrations of suspended solids in the surface waters.

Total Yearly Phosphorus Loading ($g/m^2/yr$)

| | Ft. Loudoun Reservoir | Watts Bar Reservoir | Chickamauga Reservoir | Nickajack Reservoir |
|---|---|---|---|---|
| Estimated loadings | 10.00 | 0.30 | 0.10 | 01.30 |
| Vollenweider's "eutrophic" loadings | 2.60 | 0.50 | 0.10 | 0.03 |
| Vollenweider's "oligotrophic" loadings | 1.01 | 1.10 | 1.00 | 0.01 |

## V. LITERATURE REVIEWED

Clark, Larry R. 1976. Personal communication (Nutrient loadings for C. F. Industries sewage plant) Tennessee Valley Authority, Water Quality Section, Chattanooga, Tennessee.

Tennessee Department of Public Health. 1974. Water Quality Management Plans for the Upper and Lower Tennessee River Basins. Division of Water Quality Control, Nashville, Tennessee.

Tennessee Valley Authority, Stream Sanitation Staff. 1964. Quality of Water in Chickamauga Reservoir. Chattanooga, Tennessee.

_____. 1967. Quality of Water in Watts Bar Reservoir. Chattanooga, Tennessee.

U.S. Environmental Protection Agency. 1971. The 1968 Inventory of Municipal Waste Facilities. EPA Publication No. OMP-1, Volume 4. U.S. Government Printing Office, Washington, D.C.

_____. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center-Las Vegas, Nevada and Pacific Northwest Environmental Research Laboratory-Corvallis, Oregon.

Vollenweider, Richard A. 1975. Input-Output Models With Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Z. Hydrol. 37:53-84.

# VI. APPENDICES

## APPENDIX A

## CONVERSION FACTORS

## CONVERSION FACTORS

Hectares x 2.471 = acres

Meters x 3.281 = feet

Cubic meters x $8.107 \times 10^{-4}$ = acre feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

# APPENDIX B

# TRIBUTARY FLOW DATA

LAKE CODE =717 =NAME LOCATION REFERENCE=

TOTAL =RECARZ AREA OF LAKE(FT) =47 7x17x4.5

| SUB-DRAINAGE | | | | | | | TRAVEL TIME FLOWS(DAYS) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SUB-DRAINAGE AREA(SQ MI) | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
| 13771.2 | 247.41 | 284.07 | 278.71 | 171.67 | 136.77 | 143.47 | 196.17 | 228.54 | 197.65 | 284.71 | 299.25 | 248.13 | 213.27 |
| 4774.8 | 184.34 | 228.62 | 154.41 | 217.54 | 118.36 | 74.78 | 64.28 | 86.37 | 46.42 | 45.27 | 51.62 | 90.65 | 124.24 |
| 43.7 | 1.25 | 1.77 | 1.77 | 2.47 | 5.78 | 8.34 | 8.34 | 8.25 | 8.19 | 8.17 | 8.49 | 8.43 | 8.72 |
| 17.8 | 8.141 | 8.711 | 8.741 | 8.748 | 8.247 | 8.174 | 8.117 | 8.108 | 8.091 | 8.171 | 8.284 | 8.284 | 8.395 |
| 44.9 | 1.17 | 1.75 | 1.15 | 8.98 | 8.71 | 8.19 | 8.46 | 8.25 | 8.19 | 8.16 | 8.18 | 8.85 | 8.77 |
| 24.2 | 8.99 | 1.17 | 1.13 | 8.88 | 8.45 | 8.25 | 8.29 | 8.18 | 8.12 | 8.11 | 8.32 | 8.24 | 8.47 |
| 2473.5 | 439.19 | 514.74 | 434.14 | 394.68 | 262.42 | 222.49 | 269.47 | 323.39 | 252.49 | 331.35 | 359.85 | 338.91 | 371.59 |
| 594.8 | 2.98 | 2.65 | 2.43 | 2.88 | 1.89 | 8.74 | 8.72 | 8.61 | 8.23 | 8.45 | 8.68 | 1.43 | 1.45 |
| 12.1 | 8.271 | 8.351 | 8.348 | 8.274 | 8.174 | 8.113 | 8.117 | 8.149 | 8.852 | 8.2869 | 8.1132 | 8.2215 | 8.2161 |
| 885.9 | 27.27 | 38.98 | 38.98 | 38.84 | 16.37 | 11.84 | 10.14 | 9.54 | 9.98 | 9.85 | 13.17 | 21.75 | 18.49 |
| 44.6 | 1.51 | 2.71 | 2.21 | 1.15 | 8.41 | 8.81 | 8.58 | 8.53 | 8.27 | 8.37 | 8.73 | 1.28 | 1.85 |
| 194.2 | 2.17 | 2.17 | 1.74 | 1.42 | 8.42 | 8.43 | 8.29 | 8.43 | 8.26 | 8.54 | 8.98 | 8.48 | 1.28 |
| 24.5 | 8.567 | 8.742 | 8.747 | 8.523 | 8.386 | 8.299 | 8.194 | 8.178 | 8.892 | 8.124 | 8.245 | 8.485 | 8.352 |
| 4.8 | 8.294 | 8.354 | 8.278 | 8.281 | 8.152 | 8.134 | 8.845 | 8.854 | 8.841 | 8.839 | 8.188 | 8.181 | 8.159 |
| 4.1 | 8.294 | 8.327 | 8.248 | 8.173 | 8.118 | 8.872 | 8.874 | 8.847 | 8.838 | 8.833 | 8.853 | 8.858 | 8.175 |
| 4.3 | 8.294 | 8.427 | 8.427 | 8.297 | 8.177 | 8.134 | 8.187 | 8.181 | 8.852 | 8.878 | 8.134 | 8.224 | 8.288 |
| 373.3 | 13.47 | 19.17 | 14.73 | 13.59 | 7.96 | 5.47 | 5.24 | 4.76 | 1.48 | 3.31 | 8.43 | 12.48 | 8.19 |

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 2473.5
SUM OF SUB-DRAINAGE AREAS = 2467.4

TOTAL FLOW IN = 4342.19
TOTAL FLOW OUT = 4451.88

MEAN MONTHLY FLOWS AND JULY FLOWS(CFS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 717241 | 4 | 73 | 262.21 | 14 | 137.47 | | | | |
| | 5 | 73 | 345.46 | 12 | 386.49 | | | | |
| | 6 | 73 | 342.63 | 2 | 713.54 | | | | |
| | 7 | 73 | 288.74 | 24 | 387.49 | | | | |
| | 8 | 73 | 314.80 | 11 | 354.24 | | | | |
| | 9 | 73 | 733.33 | 9 | 746.42 | | | | |
| | 10 | 73 | 246.40 | 14 | 62.49 | | | | |
| | 11 | 73 | 148.69 | 19 | 85.47 | | | | |
| | 12 | 73 | 247.32 | 31 | 209.42 | | | | |
| | 1 | 74 | 686.54 | 27 | 737.29 | | | | |
| | 2 | 74 | 455.23 | 18 | 536.69 | 21 | 428.92 | | |
| | 3 | 74 | 294.11 | 9 | 318.34 | 24 | 234.71 | | |

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SUM OF SUBWATERSHED AREAS = [illegible] TOTAL FLOW OUT = [illegible]

[illegible] [illegible] FLOWS AND DAILY FLOWS(CMS)

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| | 5 | 73 | [illegible] | 24 | [illegible] | | | | |
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LAKE TITE AREA [illegible]

TOTAL DRAINAGE AREA IN [illegible] AT [illegible]

| [illegible] | SUBDRAINAGE AREA SQ MI | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

TOTAL DRAINAGE AREA OF LAKE = [illegible]
SUM OF SUBDRAINAGE AREAS = [illegible]

TOTAL FLOW IN = [illegible]
TOTAL FLOW OUT = [illegible]

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

| [illegible] | [illegible] | [illegible] | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | 4 | 73 | [illegible] | 15 | [illegible] | | | | |
| | 5 | 73 | [illegible] | 15 | [illegible] | | | | |
| | 6 | 73 | [illegible] | 15 | [illegible] | | | | |
| | 7 | 73 | [illegible] | 24 | [illegible] | | | | |
| | 8 | 73 | [illegible] | 11 | [illegible] | | | | |
| | 9 | 73 | [illegible] | 16 | [illegible] | | | | |
| | 10 | 73 | [illegible] | 7 | [illegible] | | | | |
| | 11 | 73 | [illegible] | 10 | [illegible] | | | | |
| | 12 | 73 | [illegible] | 18 | [illegible] | | | | |
| | 1 | 74 | [illegible] | 13 | [illegible] | | | | |
| | 2 | 74 | [illegible] | 10 | [illegible] | 23 | [illegible] | | |
| | 3 | 74 | [illegible] | 4 | [illegible] | 24 | [illegible] | | |
| | 4 | 74 | [illegible] | | | | | | |

[illegible]

[illegible]

| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

# APPENDIX C

# PHYSICAL AND CHEMICAL DATA

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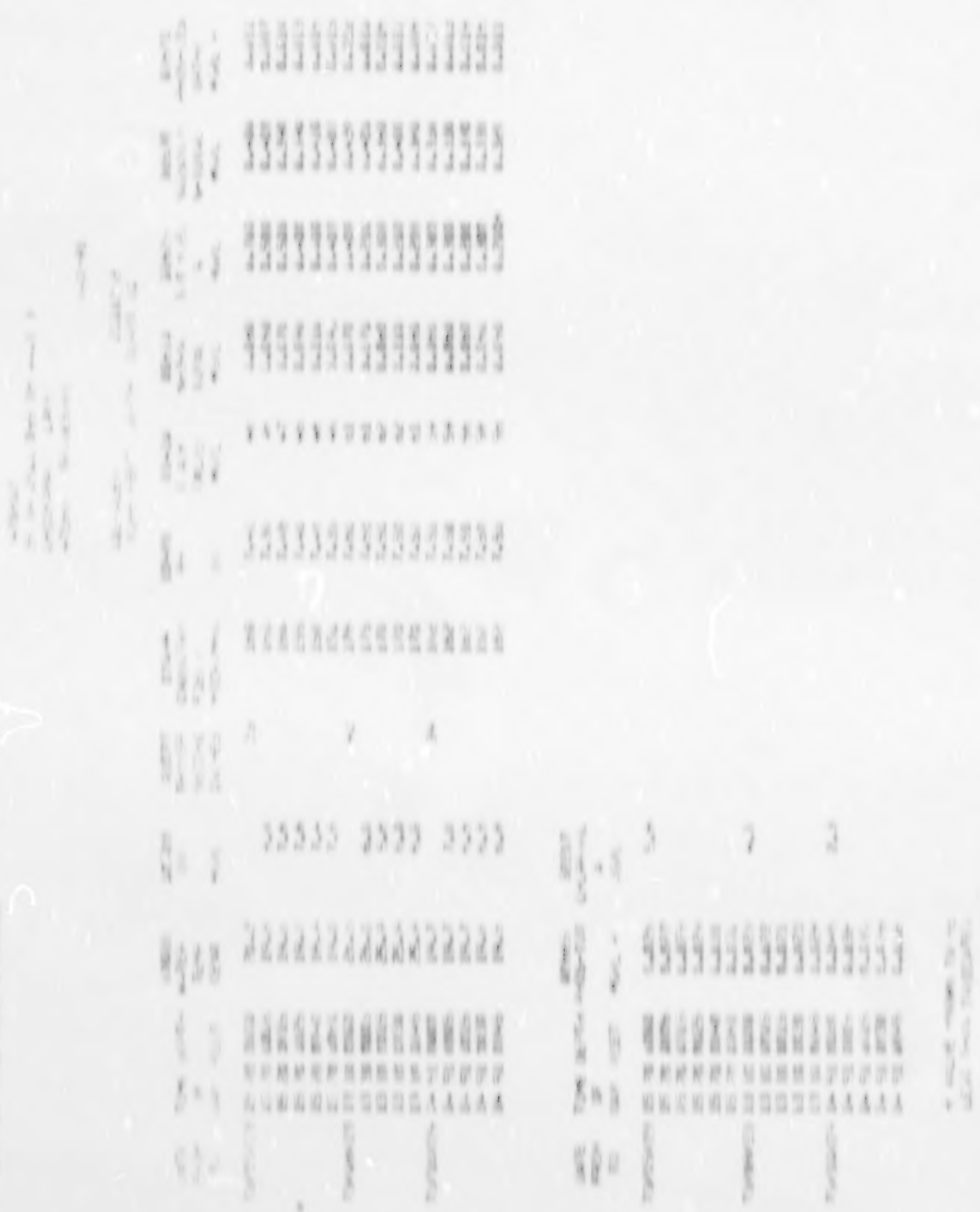

# APPENDIX D

# TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

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best available copy.

[illegible]

[illegible]

| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

[illegible]
[illegible]

[illegible]

| [illegible] | | | | | | | |
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| [illegible] | | | | | | | |
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| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |

* [illegible]
LESS THAN INTENDED

[illegible]

[illegible]

| DATE | TIME | DEPTH | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|
| FILE | ID | | WATER | N | TOTAL | DATA | |
| TO | HOT | FEET | MG/L | MG/L | MG/L | MG/L + | MG/L - |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |
| [illegible] | | | | | | | |

* VALUE GIVEN IS MDL
LESS THAN INDICATED

[illegible]

[illegible]

| [illegible] | | | | | | | | | |
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| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |

* [illegible]
[illegible]

[illegible]

[illegible]

| [illegible] | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| [illegible] | | | | | | | | | | |
| [illegible] | | | | | | | | | | |
| [illegible] | | | | | | | | | | |

[illegible]

[illegible]

| DATE | TIME | DEPTH | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| 7/28/17 | 09:17 | | | | | | | | |
| [illegible] | | | 6,970 | 13,980 | 1,330 | 1,180 | 1,460 | 13,580 | 7,280 |
| 7/28/17 | 09:33 | | | | | | | | |
| 7/28/17 | 09:53 | | | | | | | | |
| [illegible] | | | 6,130 | 12,880 | 1,740 | 1,320 | 1,760 | 1,490 | 7,420 |
| 7/28/17 | 10:07 | | | | | | | | |
| 7/28/17 | 10:27 | | | | | | | | |
| [illegible] | | | 5,870 | 13,600 | 0.105 | 1,490 | 2,060 | | |
| 7/28/17 | 10:53 | | | | | | | | |
| 7/28/17 | 11:09 | | | | | | | | |
| [illegible] | | | 8,630 | 23,100 | 1,420 | 1,480 | 1,660 | 1,120 | 1,380 |
| 7/28/17 | 11:27 | | | | | | | | |
| 7/28/17 | 11:41 | | | | | | | | |
| [illegible] | | | 8,840 | 25,280 | 1,410 | 1,350 | 1,380 | 1,270 | 1,720 |
| 7/28/17 | 11:58 | | | | | | | | |
| 7/28/17 | 12:09 | | | | | | | | |
| [illegible] | | | 6,700 | 1,330 | 1,840 | 1,210 | 1,470 | 1,240 | 1,210 |
| 7/28/17 | 12:26 | | | | | | | | |
| 7/28/17 | 12:40 | | | | | | | | |
| [illegible] | | | 6,640 | 17,880 | 1,320 | 1,130 | 1,490 | 1,390 | 1,230 |
| 7/28/17 | 12:55 | | | | | | | | |
| 7/28/17 | 13:09 | | | | | | | | |
| [illegible] | | | 6,610 | 3,180 | 1,270 | | 1,280 | 21,490 | 13,280 |
| 7/28/17 | 13:27 | | | | | | | | |
| 7/28/17 | 13:41 | | | | | | | | |
| [illegible] | | | 6,310 | 7,280 | 1,740 | 1,140 | 2,220 | | 1,480 |
| 7/28/17 | 13:57 | | | | | | | | |
| 7/28/17 | 14:11 | | | | | | | | |
| [illegible] | | | 6,260 | 1,470 | 1,720 | 1,380 | 1,490 | | |
| 7/28/17 | | | | | | | | | |
| 7/28/17 | 14:37 | | | | | | | | |
| [illegible] | | | 1,700 | 8,280 | 1,110 | 1,470 | 2,470 | | |
| 7/28/17 | 14:53 | | | | | | | | |
| 7/28/17 | 15:07 | | | | | | | | |
| [illegible] | | | 1,240 | 12,270 | 1,430 | 1,180 | 1,660 | 1,210 | |
| 7/28/17 | 15:24 | | | | | | | | |

[illegible]

[illegible]

[illegible]

[illegible]

| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

[illegible]

| DATE | TIME | DEPTH | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | MG/L | MG/L | MG/L | MG/L P | MG/L P | [illegible] | [illegible] |
| [illegible] | | | | | | | | | |
| [illegible] | | | 0.245 | 25.000 | 1.445 | 0.345 | 1.234 | 3.765 | 2.588 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | 23.435 | 1.751 | 3.490 | 3.116 | 2.488 | 3.116 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | 0.449 | 75.188 | 0.748 | 2.189 | 2.836 | 2.766 | 2.176 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | 0.239 | 28.688 | 0.580 | 2.161 | 1.380 | 3.125 | 3.188 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | 0.136 | 11.988 | 0.256 | 3.887 | 3.135 | 2.548 | 3.356 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | 2.410 | 2.542 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | 16.538 | | | | 3.256 | 2.489 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | 2.795 | 2.995 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | 28.285 | | | | 2.760 | 3.010 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | 3.088 | 3.479 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | 25.485 | | | 1.198 | 1.705 | 2.220 |
| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
| [illegible] | | | | 22.788 | | | 2.234 | 2.148 | 2.478 |
| [illegible] | | | | | | | | | |

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[illegible]

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| [illegible] | | | | | | | | | |
| [illegible] | | | | | | | | | |
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* [illegible]

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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
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# APPENDIX E

## PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1974

## STATE OF TENNESSEE

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| LAKE CODE | LAKE NAME | [illegible] TOTAL * | [illegible] DELTA † | [illegible] MEAN SEC | [illegible] [illegible] | [illegible] CO [illegible] | [illegible] [illegible] | [illegible] |
|---|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | 13 ± 23 | 48 ± 84 | 13 ± 23 | 7 ± 13 | 73 ± 127 | 13 ± 23 | 154 |
| [illegible] | [illegible] | 42 ± 73 | 8 ± 13 | 73 ± 127 | 23 ± 40 | 47 ± 73 | 23 ± 39 | 214 |
| [illegible] | [illegible] | 7 ± 13 | 47 ± 73 | 7 ± 13 | 43 ± 67 | 90 ± 139 | 0 ± 0 | 194 |
| [illegible] | [illegible] | 58 ± 79 | 7 ± 13 | 53 ± 93 | 13 ± 23 | 13 ± 83 | 40 ± 63 | 176 |
| [illegible] | [illegible] | 57 ± 100 | 63 ± 90 | 33 ± 57 | 43 ± 140 | 90 ± 139 | 70 ± 120 | 406 |
| [illegible] | [illegible] | 73 ± 113 | 63 ± 90 | 47 ± 103 | 40 ± 129 | 13 ± 84 | 66 ± 90 | 264 |
| [illegible] | [illegible] | 33 ± 53 | 28 ± 39 | 27 ± 40 | 73 ± 113 | 96 ± 96 | 27 ± 40 | 240 |
| [illegible] | [illegible] | 67 ± 123 | 73 ± 113 | 60 ± 96 | 67 ± 139 | 40 ± 63 | 93 ± 140 | 440 |
| [illegible] | [illegible] | 58 ± 73 | 33 ± 53 | 47 ± 73 | 186 ± 153 | 80 ± 123 | 33 ± 53 | 340 |
| [illegible] | [illegible] | 26 ± 39 | 80 ± 123 | 20 ± 30 | 33 ± 53 | 103 ± 159 | 53 ± 83 | 386 |
| [illegible] | [illegible] | 60 ± 90 | 27 ± 40 | 43 ± 93 | 67 ± 103 | 67 ± 103 | 70 ± 109 | 334 |
| [illegible] | [illegible] | 27 ± 40 | 108 ± 159 | 60 ± 120 | 27 ± 40 | 13 ± 83 | 47 ± 73 | 294 |
| [illegible] | [illegible] | 83 ± 123 | 53 ± 83 | 100 ± 154 | 60 ± 90 | 33 ± 53 | 80 ± 123 | 426 |
| [illegible] | [illegible] | 100 ± 153 | 13 ± 23 | 93 ± 140 | 47 ± 73 | 23 ± 83 | 87 ± 133 | 363 |
| [illegible] | [illegible] | 0 ± 0 | 93 ± 140 | 0 ± 0 | 0 ± 0 | 53 ± 83 | 7 ± 13 | 153 |
| [illegible] | [illegible] | 93 ± 140 | 87 ± 133 | 87 ± 133 | 53 ± 83 | 13 ± 83 | 200 ± 154 | 433 |

LAKE DATA TO BE USED IN ANALYSIS

| LAKE ID | LAKE NAME | [illegible] TOTAL * | [illegible] DEPTH * | [illegible] MEAN DEPTH | [illegible] VOLUME | [illegible] MEAN | [illegible] LOCATION * |
|---|---|---|---|---|---|---|---|
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |